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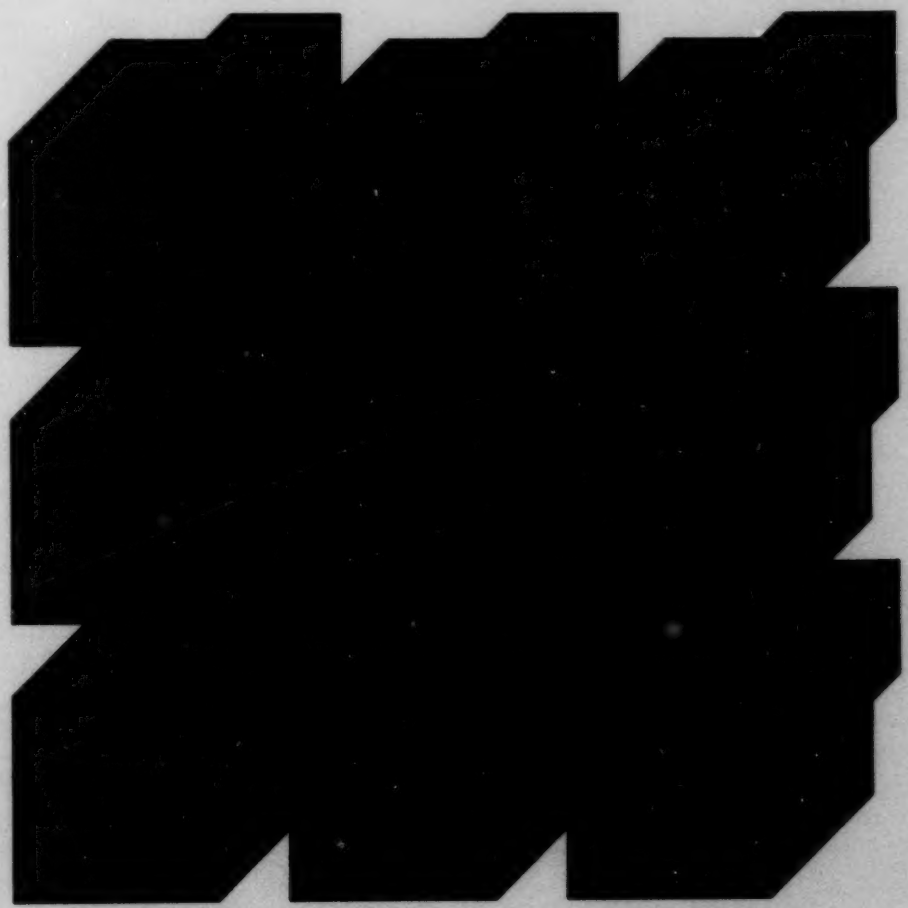

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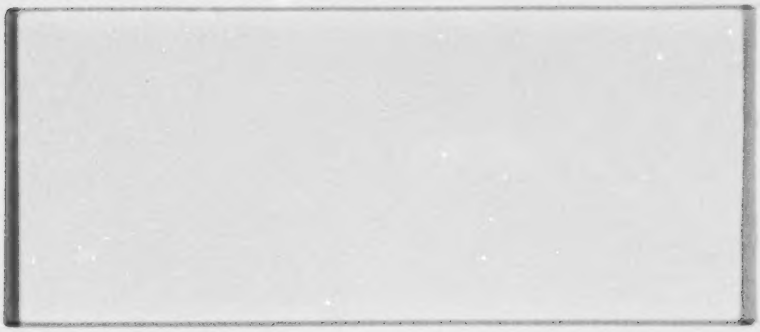

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DISCUSSION PAPER NO. 264

The Saskatchewan Potash Industry: Alternative Strategies for Future Development

By David L. Anderson

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RÉSUMÉ

Cette étude présente une évaluation de l'industrie de la potasse de la Saskatchewan à un moment crucial de sa courte et difficile histoire. Plus précisément, l'auteur examine les options qui s'offrent à la province de la Saskatchewan pour maximiser les bénéfices nets qu'elle peut tirer de ses vastes dépôts de potasse. La première étape de l'analyse porte sur la structure fiscale. Cet aspect est particulièrement important puisque l'accord actuellement en vigueur dans ce domaine, le Potash Resource Payments Agreement (PRPA), arrive à échéance le 30 juin 1984. Les résultats indiquent que, même si l'on peut admettre de menus changements au régime de rentes s'appliquant actuellement à cette resource, sa structure fondamentale ne devrait pas être modifiée. Cette conclusion découle de la supposition que c'est surtout par le biais de recettes fiscales que la province s'approprie la plupart des bénéfices qu'elle retire de l'exploitation de cette ressource non renouvelable. Cette observation se fonde en outre sur les caractéristiques suivantes de l'industrie : fort coefficient de capital; degré élevé de propriété étrangère; et enfin, incidence minimale sur le reste de l'économie, c'est-à-dire que ses liens avec elle, en aval et en amont, sont relativement ténus.

Étant donné que la demande de potasse - le fait est bien reconnu - est très peu sensible aux variations de son prix de vente, et qu'il n'existe pas actuellement de substituts au chlorure de potassium, il semble que cette industrie constitue un bon sujet pour la cartellisation. Cette question fait d'ailleurs l'objet d'une analyse assez détaillée dont les résultats indiquent que le gouvernement provincial devrait continuer à encourager tous les

producteurs à rester groupés dans le Canadian Potash Exporters' Association (Canpotex), à contrôler étroitement l'expansion de l'industrie et, peut-être, à réglementer l'utilisation de la capacité de production actuelle. En général, les résultats montrent que la principale tâche de l'industrie consiste à formuler des ententes de commercialisation convenables et non à stimuler l'expansion et la production.

D'après les principales recommandations de la présente étude, la Saskatchewan devrait : continuer de recourir à des taxes variant selon les profits tirés des ressources; s'assurer que toutes les ventes hors de l'Amérique du Nord continuent d'être négociées par une seule agence; voir à s'assurer de la bonne utilisation par la province de sa position dominante sur le marché nord-américain; et enfin, entreprendre des études devant estimer l'élasticité fondamentale de l'offre et de la demande dont doivent tenir compte les producteurs de la Saskatchewan, et devant également évaluer les rentes additionnelles à long terme qu'il pourrait être possible de s'approprier moyennant d'autres ententes de commercialisation.

ABSTRACT

This study assesses the Saskatchewan potash industry at a crucial time in its short but turbulent history. More explicitly, it attempts to explore the options available to the Province of Saskatchewan in order to maximize the net benefits obtainable from its vast potash deposits. The first stage of the analysis focuses on the tax structure; this is of particular importance since the current regime, the Potash Resource Payments Agreement (PRPA), is up for renewal on 30 June 1984. The findings suggest that although minor changes to this crude resource rent scheme are in order, the basic structure should not be altered.. This statement follows from the supposition that it is primarily through the capture of tax revenue that the Province appropriates most of its benefits from the exploitation of this non-renewable resource. This observation is, in turn, based on the following industry characteristics: it is highly capital intensive; exhibits a large degree of non-resident ownership; and has a minimal impact on the rest of the economy - that is, its associated forward and backward linkages are relatively small.

Given the conventional wisdom that the demand for potash is highly insensitive to selling price and that no substitutes for potassium chloride currently exist, the industry appears to be a strong candidate for cartelization. This issue is explored in some depth. The results suggest that the provincial government should continue to encourage all producers to remain in Canpotex; closely control industry expansions; and, perhaps, regulate utilization of existing capacity. In general, the findings indicate that the major issue facing the industry is one of specifying suitable marketing arrangements, not that of stimulating expansion and output per se.

The major recommendations of the study are that the Province of Saskatchewan should: continue to rely on profit sensitive resource rent taxes; ensure that all sales outside North America continue to be handled by a single selling agency; give consideration to ensuring that the Province's inherent market power in the North American market be properly utilized; and undertake studies to estimate the underlying supply and demand elasticity facing Saskatchewan producers and the incremental long-term rents which could be captured under alternative marketing arrangements.

CHAPTER 1: INTRODUCTION

The purpose of this study is to outline and assess those issues which critically affect the future of the Saskatchewan potash industry. More specifically, the analysis will focus on the potential contribution of the industry to the province's future economic growth. In doing so, primary attention will be given to the direct impact of the industry on such indicators as provincial domestic product, employment and tax revenue. The indirect impacts generated through the multiplier effect will be largely ignored; the rationale for this rests on two factors: first, it is assumed that in the long-run, all factors of production would otherwise be fully employed; and second, with respect to the Saskatchewan economy, the backward and forward linkages generated by potash development, are quite limited.

Before proceeding, a further qualification is in order. In assessing benefits and costs, the relevant domain is assumed to be the Province of Saskatchewan. Hence, policies may be promulgated which appear to be suboptimal when viewed from a national and, in particular, an international perspective. Rephrased, the analysis gives significant weight to distributional issues: the nationality of the winners and the losers is relevant to this study since it is likely to be given significant weight by provincial politicians and their advisors.

Since public policy issues are frequently shaped by past events, let us now digress to consider a brief history of the potash industry from both an international and a provincial perspective.

1.1 Brief History

Potassium (K), Nitrogen (N), and Phosphate (P) are all required for plant growth. Given soil depletion of these naturally occurring elements due

largely to continuous cropping practices, they must be replaced if crop yields are to be maintained and, equally important, provided in greater quantity if productivity is to be increased in order to provide an adequate food supply for an ever growing populace.

Although potassium is one of the most common substances to be found in the earth's crust, it must be present in a soluble form in order to be of use as a plant nutrient.[1] Approximately 90% of such needs are currently met by potassium chloride (KCL) which is widely known as "potash" or "muriate of potash".

Despite the fact that all plant growth leads to the depletion of naturally occurring potassium, the net draw-down varies dramatically between crops. In general, leaf crops such as hay, alfalfa and tobacco are high net consumers of K; on the other hand, cereal crops, although high gross consumers, return much potassium to the soil in the form of stubble.[2]

In order to facilitate comparison of the nutritional value of various forms of soluble potassium and also varying grades and quality among alternative sources of KCL, output is normally expressed in terms of potassium oxide (K_2O) equivalent. In its pure state, KCL contains 63.2% K_2O, but the commercially available product usually contains between 60-62% K_2O equivalent.[3]

The role of potassium in the nutrient cycle is as follows:

> the application of potash ensures the maximum effectiveness of the other fertilizer ingredients. Potassium contributes to healthy plant growth, aids in synthesis and translocation of starch and sugars, is essential for good flower colour and ripeness in fruits, stiffens straw in cereals, promotes development of root systems and enables the plant to withstand adverse conditions of soil, climate and disease.[4]

It is important to note that there are no known substitutes for soluble potassium as a constituent element of commercial fertilizers; however, there

are several chemical compounds which can serve this purpose. Although KCL is the lowest cost source of K, there is obviously a point at which it becomes economical to substitute other forms of soluble potassium for KCL.

1.2 The Development of the Saskatchewan Deposits

Large scale potash deposits were first developed in Germany in the 1860's; within a few years, the mines had organized an effective cartel which remained in place until after WWI.[5] After a period of unrestrained price competition from the newly opened French mines, another cartel was formed. Under the terms of the arrangement, the market was divided 70:30 between the German and French mines. Not unexpectedly, the resulting "high" prices acted as a catalyst for exploration activity and in the late 1920's and early 1930's deposits were found in the United States, Spain, Palestine, and the U.S.S.R, which were commercially viable at the cartel price. Once again, the cartel collapsed only to be replaced in the 1940's and 1950's by informal collusive behaviour. This arrangement was dramatically altered by the entry of Canadian and U.S.S.R. producers in the 1960's. However, according to Van Rensburg and Bambrick,[6] by the late 1970's the potash industry appeared to, once again, display signs of collusive behaviour. In summary, as noted by Koepke,[7] the potash industry has almost always been characterized by some degree of cartelization.

Potash was first discovered in Saskatchewan in 1942 at Radville, 130 kms. south of Regina, by an Imperial Oil drilling crew.[8] Although the find was promising, it was deemed to be located at a depth (2,330 metres) which precluded extraction. However, when a similar find was made at 1,056 metres at Unity (190 kms. west of Saskatoon) in 1946, the deposits attracted commercial interest. Nevertheless, it was not until 1962 that technological prob-

lems were overcome which allowed the industry to enter the commercial production stage.

There are a number of reasons for this long lag between discovery and production. First, the CCF government attempted to develop the deposits through a public/private joint venture format. After this option failed to elicit a positive private sector response, various royalty schemes were proposed. However, it was not until 1951 that an investor was found willing to abide by the government's terms. Unfortunately, the firm, Western Potash Corporation Limited, was under-capitalized and the venture floundered; after several years of sporadic drilling activity, the shaft flooded and the property was subsequently abandoned.[9]

The next entrant was the Potash Company of America (PCA) which initiated drilling activities in 1952. By 1959, the resulting mine commenced commercial production only to also have its shaft flooded shortly thereafter; this problem was finally overcome in 1965 - after the expenditure of an additional $25 million.[10]

The above noted flooding problem was attributable to an intense high pressure water-bearing strata, known as the Blairmore formation. It was finally conquered in 1962 by International Minerals and Chemicals Co. (IMC), through the use of a West German developed tubbing technique. As a result of IMC's pioneering efforts, eight additional mines entered production over the following eight year period. Hence, by 1970, 9 conventional mines and 1 solution venture were in operation. They were constructed at a cost of $684 million ($2,104 million in constant 1982 dollars), and were capable of producing 7.57 million tonnes K_2O per annum.[11]

The post-1962 expansion can be attributed to a number of factors: the 1960's were designated by the United Nations as the Development Decade which

focussed attention on the world's food requirements; the overcoming of the previously described technological problems; the New Mexico reserves were rapidly declining; the Thatcher government extended the time horizon of the rather modest, prevailing tax structure and, furthermore, required rapid development in order to avoid cancellation of leases; and prevailing K_2O prices were more than sufficient to generate an acceptable rate-of-return on investment.[12]

The Saskatchewan-based expansions of the 1960's constituted a 75% increase in world capacity over that existing at the start of the period.[13] In addition, the U.S.S.R. expanded in a similar fashion; overall, total world productive capacity increased by 139% during the 1960's.[14] Although global demand escalated by 5.9% per annum,[15] a situation of massive "over-supply" developed. Not surprisingly, between 1965 and 1969, the price declined from \$41 to \$22/tK_2O. Consequently, some of the Saskatchewan-based producers were threatened with financial collapse due to their heavy debt-servicing costs.

By the late 1960's the situation was showing signs of further deterioration; this was primarily due to the economic hardship being encountered by the high cost New Mexico producers.[16] As they started to lay-off workers, political pressure mounted. Eventually several bills were introduced in Congress which attempted, in one fashion or another, to curb the flow of product into the U.S.A. Since approximately 70% of Saskatchewan's total potash export were shipped to the U.S. market (representing 93% of U.S. imports), the province's producers and government had cause for worry. The problem became acute when the U.S. Treasury initiated charges of dumping against Canada, France and West Germany. In August 1969 they deemed that this had indeed occurred and that the case would be referred to the U.S. Tariff Com-

mission to determine the nature of the restrictions to be placed on potash entering the U.S. market.

Pressure mounted on the Thatcher government to find a workable solution to the emerging crisis; it was clear that the key to the problem was to find a mechanism which would increase the fortunes of the U.S. operators. After exploring several alternatives, the Potash Conservation Regulations[17] were announced on 21 November 1969, with effect from 1 January 1970. Under this plan, known as the prorationing scheme,[18] each producer was granted a base quota equal to its proportion of total industry capacity multiplied by expected provincial potash sales for the upcoming year. In addition, firms with long-term contracts were able to exceed their base quota and a further adjustment was made for opening inventory differentials among producers. Furthermore, a minimum price was established which, if violated would lead to the cancellation of the operator's production license. The initial production quota was set at 40% of rated capacity and the minimum price at \$33.75/s.t.K_2O. The prorationing scheme achieved its short-run objective: in its first year of operation, output declined by 6.7% but total sales revenue increased by 57%. The corresponding figures for the second year were increases of 12.6% and 34.2%.[19,20]

In 1972, the Blakeney government, which had assumed office in the preceding year, altered the quota allocation system: each producer now received a production quota which was entirely based on their share of total output capacity multiplied by expected sales of Saskatchewan potash during the forthcoming period. This meant that Central Canada Potash, which had a sales agreement with a U.S. co-operative for virtually all of its output, was now forced to buy products from other firms.[21] Not surprisingly, it responded by

challenging the constitutional validity of the scheme; after conflicting decisions in the lower courts, the scheme was declared ultra vires of provincial powers by the Supreme Court of Canada in 1979. Although this was an important decision with respect to federal/provincial constitutional issues, it was of little significance to the prorationing scheme, per se. As a result of a strong upward shift in demand for potash in 1973-74, attributable to "boom" conditions in the international grain markets, the program had become superfluous and was essentially abandoned in 1974.[22]

Over this time period, the Blakeney government became increasingly dissatisfied with its share of perceived industry profits.[23] According to the government, the industry had been rescued from imminent destruction by public initiatives and, hence, the beneficiaries should share the new found spoils with the "true" owners of the resource - the people of Saskatchewan. On the other hand, the operators believed that the increased profits were needed to offset the effects of the 1968-1971 slump. More specifically, they had yet to recover their initial capital outlay or, from an accounting perspective, to earn a reasonable rate of return on their investment. Needless to say, the NDP regime viewed this as a severe case of ingratitude. They responded, in 1974, by unleashing a new tax instrument, the Potash Reserve Tax (RT), which undoubtedly acted as the catalyst for the resulting five year struggle between the producers and the government for effective control of the province's potash reserves.

The RT was strongly resisted by the producers: they, at times, withheld the required payments; refused to provide financial information as required under the Potash Conservation Regulations; and initiated an aggressive media and legal campaign against the Blakeney government. The latter responded by

defending the validity of the RT and by taking their case to the electorate. After the NDP victory in June 1975, the firms challenged the constitutional validity of the Reserve Tax.[24]

This action was interpreted as all out "war" by the NDP. Immediately thereafter they drew up battle plans which were unveiled in the November 1975 Speech-from-the-Throne: the document called for nationalization of the industry, by expropriation if necessary, and the explicit formation of a state potash company: the Potash Corporation of Saskatchewan (PCS).[25] Over the 1976-1978 period, PCS expended $532 million to acquire total ownership of three mines, a 60% interest in a fourth, and ownership of an ore body mined under contract by a private firm.

A truce was formally reached in late 1979 when all producers signed individual contracts with the Blakeney government. Under these agreements, each operator agreed not to proceed with or to initiate legal action against the government during the course of the five year agreement; in return, the government provided a more modest tax regime but one which continues to be, when judged by Canadian mining standards, rather harsh.

The industry continued to prosper until late 1981 when its fortunes were seriously affected by the current world-wide recession. However, it now (December 1983) appears as if the potash sector is entering a period of strong economic recovery.[26]

1.3 Brief Overview of the Major Issues Facing the Industry

Before outlining the major issues currently facing the Saskatchewan potash industry, it should be noted that the Blakeney government was defeated in the 26 April 1982 provincial election by the Conservative Party under the leadership of Grant Devine. Shortly thereafter, the then Minister for Energy

and Mines announced that the new government looked toward the private sector to carry out all new expansion activities; in other words, the activities of the Potash Corporation of Saskatchewan (PCS) were to be severely restricted. Although recent events suggest a softening in this position, the reader is advised to keep the former policy announcement in mind throughout the remainder of this study.

The Saskatchewan potash industry is currently operating at approximately 65% of design capacity[27] and obtaining sales prices which, in real terms, are only 60% of that received during the boom of 1980 and 1981.[28] Although the industry should benefit by the emerging upturn in the economy, additional capacity is about to enter the market; this may retard any significant improvement in selling price. Interestingly, much of this new incremental capacity is located in New Brunswick:[29] PCA opened a mine in October 1983; Denison is constructing a 830,000 tpy K_2O venture which is expected to enter commercial production in 1986; and British Petroleum is also exploring the possibility of constructing a mine in this province. In addition, new facilities are under construction in Jordan, Brazil and the U.S.S.R.

This potential "oversupply" problem may be exacerbated by the Devine government's apparent desire for Saskatchewan-based industry expansion. Since the current tax structure, as embodied in the Potash Resource Payments Agreement(PRPA), lapses on 30 June 1984, a new tax scheme is presently being negotiated by government and industry officials. The industry claims that it requires increased cash-flows if it is to expand; however, it appears as if the provincial government is reluctant to reduce taxes without a guarantee that these funds will be invested within Saskatchewan.[30] If the latter failed to occur, the Devine government would be in the embarassing position

of being seen to be merely transferring economic rent from the citizens of Saskatchewan to private, non-resident investors.

This brief discussion indicates that the distribution of economic rents is up for review, as is the larger and interrelated question of the appropriate size of the industry.

1.4 Structure of the Study

The basic objective of this study is to explore the potential contribution of the potash industry to the longer-term economic development of the Province of Saskatchewan. This will be addressed by first providing a rather detailed discussion of the geological, technical, and economic characteristics of the industry. In the third chapter, the question of economic rent and hence taxation regimes will be explored. Chapter 4 contains an assessment of the degree to which the province's market power could be used to capture incremental monopoly rents. This leads to a discussion of the current marketing system and to plausible alternatives. The paper concludes with a presentation of my findings and recommendations.

FOOTNOTES

1. For a discussion of the uses and properties of potash see Anne Fuzesy, Potash in Saskatchewan, Report 181 (Regina: Saskatchewan Energy and Mines, 1982), pp. 1-14.

2. Ibid., p. 5.

3. For purposes of this study K_2O = 1.64 KCL. Furthermore, all physical units refer to metric tons K_2O (t K_2O) unless otherwise stated.

4. Anne Fuzesy, op.cit., p. 5.

5. The following historical discussion draws heavily from W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, Energy, Mines and Resources Canada Report MR 139 (Ottawa: Information Canada, 1973).

6. See W.C.J. van Rensburg and Susan C. Bambrick, The Economics of the World's Mineral Industries (Johannesburg, McGraw-Hill, 1978), p. 206.

7. Ibid., p. 50.

8. For an excellent historical assessment of the Saskatchewan potash industry, from a political economy perspective, see John Richards and Larry Pratt, Prairie Capitalism: Power and Influence in the New West (Toronto: McClelland and Stewart, 1979). The reader interested in a more technologically oriented assessment, should see Koepke, op.cit. and Fuzesy, op.cit.

9. Koepke, op.cit., p. 27.

10. Ibid., p. 28.

11. See Table 10 for details.

12. See Richards and Pratt, op.cit. for details on the expansion boom of the 1960's.

13. Derived from data displayed in Table 4.

14. Derived from data displayed in Table 4.

15. Derived from Koepke, op.cit., p. 60.

16. For a detailed discussion of the events leading to prorationing, see Richards and Pratt, op.cit.; and Patrick James Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, unpublished Ph.D. thesis, University of Toronto, Toronto, 1980, Chapter 7.

17. Saskatchewan Regulations 287/69, Order in Council 1733/69, Saskatchewan Gazette, 21 November 1969.

18. For details, see D.A. Karvonen, "The Saskatchewan Potash Prorationing and Price Stabilization Program", CIM Bulletin, April 1973, pp. 1-6.

19. Derived from Table 13.

20. The reader is referred to Chapter 4 for a discussion of the factors involved in the operation and apparent success of the prorationing scheme.

21. The Central Canada Potash case is thoroughly described in William D. Moull, "Natural Resources: The Other Crisis in Canadian Federalism", Osgoode Hall Law Journal, Vol. 18, No. 1, March 1980.

22. Although not enforced, the prorationing regulations still remain technically in place at the time of writing (December 1983).

23. See David L. Anderson, The Role of Mineral Taxation in Industry/Government Conflict: The Case of the Saskatchewan Potash Reserve Tax (Kingston: Centre for Resource Studies, 1981), Chapter 1, 6.

24. For a discussion of the various potash-related court cases, see William D. Moull, op.cit.; and John Richards and Larry Pratt, op.cit., Chpt. 11.

25. The nationalization process is described in Maureen Appel Molot and Jeanne Kirk Laux, "The Politics of Nationalization", Canadian Journal of Political Science, Vol. 12, June 1978, pp. 227-258.

26. For details, see Philip L. Reeves and Maurice Hall, "Potash-Seen on the Road to Recovery", The Northern Miner, Vol. 69, No. 38, 24 November 1983, p. (B18); and "Potash Sales Strong", Leader Post, Regina, 30 November 1983, p. (E6).

27. George Barry, "Potash", Canadian Mineral Yearbook 1982 (Ottawa: Supply and Services Canada, 1983), p. 31.12; and Table 13 (this study). However, based on the information provided in the references listed in the prior footnote and from interviews with industry and government officials, the Saskatchewan potash industry was producing at about 80% of theoretical capacity in October 1983.

28. Discussions with industry officials suggests that K_2O is currently selling for approximately $100/t f.o.b. mine. This is in contrast to prices in the order of $170 in 1980 and 1981 (in 1982 constant prices). For details on historical prices, see Table 13.

29. George Barry, op.cit.

30. Based on hear-say evidence only.

CHAPTER 2 ECONOMIC AND INSITUTIONAL STRUCTURE

2.1 Reserves and Resources

According to the U.S. Bureau of Mines, Saskatchewan alone possesses approximately 74% of the world's known potash reserves and 88% of its resources.[1] As shown in Table 1, the U.S.S.R. is also a major source of soluble potassium; smaller but nonetheless substantial holdings are found in East Germany, West Germany, France, Israel, Jordan, United States, and New Brunswick.

In addition to their massive size, Saskatchewan reserves are high grade, and resident in thick and continuous seams which facilitate low cost recovery. For example, ore grade averages 25-30% K_2O; this exceeds that exhibited by any of its competitors and is approximately twice the grade currently mined by New Mexico producers. Furthermore, the finished Saskatchewan product contains 60-62% K_2O which is extremely close to the theoretical limit of 63%.

Notwithstanding its virtues, Saskatchewan ore is not extracted without difficulty. First, the potash lies at extreme depth: from 1,050 metres in the Saskatoon area to 2,500 metres at the Saskatchewan/North Dakota/Montana border. Conventional wisdom dictates that it is not feasible to employ underground techniques for the extraction of potash at depths in excess of 1,200 metres; this is due to the plasticity of the potash bearing ore under pressure. Although solution mining can be utilized to win ore from greater depth, it is a higher cost processs.

A second technological problem is the presence of a high pressure water bearing zone known as the Blairmore formation; it was the bane of the pioneer developers. Although the problem, which led to shaft flooding, was eventually overcome in 1962 by International Minerals and Chemicals (IMC), the

TABLE 1

World Potash Reserves and Resources
(Million Metric Tons, K_2O Equivalent)

	Reserves	Reserve base[3] (includes reserves)
North America:		
United States	100	300
Canada[1]	14,000	45,000
Mexico	NA	NA
Total[2]	14,000	45,000
South America:		
Brazil	5	13
Chile	1	50
Peru	NA	NA
Total[2]	6	60
Europe:		
France	50	60
German Democratic Republic	800	1,000
Germany, Federal Republic of	500	600
Italy	10	12
Spain	60	75
United Kingdom	60	75
U.S.S.R.	3,000	3,800
Total[2]	5,000	6,000
Africa:		
Congo	-	18
Ethiopa	-	-
Total[2]	-	18
Asia:		
China	200	NA
Isreal and Jordan	NA	300
Laos	NA	20
Thailand	NA	100
Total[2]	200	400
Oceania: Australia:	-	-
World Total[2]	19,000	51,000

Source: James P. Searls, "Potash", in Mineral Commodity Profiles 1983 (Washington: U.S. Bureau of Mines, 1983), p. 2.

NA Not Available

[1] Potash: A Proposed Strategy. Energy, Mines and Resources Canada, Canadian Government Publishing Center, Ottawa, Canada, MR194, January 1982, Appendix A.

[2] Data may not add to totals shown because of independent rounding.

[3] The term "reserve base" is roughly equivalent to that of "resources" as defined in footnote #1 of this chapter.

technique employed adds substantially to the cost of shaft construction.

2.2 Demand for Potash

2.2.1 Historical Data

In 1981, as shown in Table 2, the world-wide consumption of potash was 24.2 million t K_2O. Although this is double the 1966 level, the rate of increase in consumption has slowed markedly since 1976. Note that over the 1966-76 period, the average annual growth rate was 5.6%; in contrast, the corresponding figure over the 1976-81 period declined to 2.5%. A better way of observing the consumption patterns is to divide the market into two segments: developed countries (DC) and developing countries (LDC). Once again, from Table 2, two major factors are observable. First, the DC's account for approximately 84% of total demand in 1981; compared to 93% in 1966. Second, the rate of growth of consumption is dramatically higher in the LDC's: 11.2% as compared to 1.4% in the DC's over the 1976-81 period.

Another way of expressing the above information is to address the relative use of fertilizer per hectare of arable land in various regions. As shown in Table 3, Asia and Africa utilize meagre amounts of potash relative to, say, Europe, North America and the U.S.S.R. This suggests that if ability to pay problems can be overcome, significant, long-term growth potential for potash sales exists throughout the third world.

Although the growth rate in the LDC market has been higher than in the DC's, it is still much less than anticipated by government and industry officials in the early 1960's. This may be attributed to a number of factors. First, the diffusion of knowledge of the impact of potash on crop yields has been less rapid than anticipated. Second, the role of internal distribution systems was underestimated; although improvements have occurred in this area,

TABLE 2

World Potash Fertilizer Consumption: 1966-1982
(million metric tons of nutrient - K_2O equivalent)

	Years Ending June 30			Annual Growth Rates %	
				1976	1981
	1966	1976	1981	1966	1976
World Total	12.28	21.33	24.15	5.6	2.5
Developed Countries	11.45	19.00	20.33	5.2	1.4
North America	3.06	4.94	6.10	4.9	4.3
West Europe[1]	4.07	4.66	5.12	1.3	1.9
East Europe[1]	3.46	8.54	8.10	9.4	-1.1
Pacific & Others[2]	0.86	0.85	1.01	-	3.5
Developing Countries	0.83	2.33	3.97	10.9	11.2
Latin America	0.29	0.95	1.89	12.6	14.9
Africa (South of Sahara)	0.06	0.14	0.14	8.8	0.0
North Africa[3]	0.02	0.06	0.08	11.7	5.9
Middle East	0.01	0.03	-	11.6	-
South Asia[4]	0.13	0.30	0.73	8.7	19.5
East Asia	0.11	0.37	0.58	12.9	9.4
Socialist Asia[5]	0.21	0.48	0.55	8.6	2.8

Source: Derived from William F. Sheldrick and Harald Stier, World Potash Survey, World Bank Staff Working Paper No. 293 (Washington: World Bank, September, 1978), p. 41; and "Statistical Supplement", Phosphorus and Potassium, No. 123, January/February, 1983.

[1] Yugoslavia in West Europe. [2] Oceania, Japan, South Africa and Israel. [3] Algeria, Libya, Tunisia, Egypt, Morocco and Sudan. [4] Bagladesh, India, Nepal, Pakistan and Sri Lanka. [5] Cambodia, China, Taiwan, North Korea, Vietnam and Laos.

TABLE 3

Potash Fertilizer Consumption Per Hectare of Arable Land and Permanent Crop, and Per Capita

	Geographic Region	Average consumption 100 grams K_2O equivalent per hectare of arable land and permanent crop		per capita	
		1961-65	1977	1961-65	1977
population per hectare of arable land decreases	Asia*	20	50	5	10
	Europe	340	588	118	175
	South America	19	100	10	47
	Africa	7	18	4	9
	N. & C. America	105	210	95	159
	Soviet Union	50	232	51	209
	Oceania	38	53	80	113
	World	75	159	33	57

Source: 1978 FAO Fertilizer Yearbook, Table 12, Food and Agriculture Organization of the United Nations.

* Includes an estimate for China

they have not been dramatic. Third, and perhaps most important, the economic growth rates experienced in most LDC's, especially since the oil crisis of 1973, have been much less than expected by industry officials in the 1960's. This, in turn, has had a corresponding impact on the effective demand for potash-using crops and, hence, for potash itself.

2.2.2 Theoretical Issues

The demand for potash is heavily influenced by the demand for potash-intensive crops.[2] For the sake of convenience, such crops will be labelled as grain.[3] Although somewhat elementary, we may specify the demand for grain (Dg) as a function of: the price of grain (Pg); the price of other commodities (Pog); the level of income (Y); and the community's tastes (T). The analysis can be simplified by assuming tastes and the prices of other goods to be constant. This allows me to concentrate on the price and income elasticities of the demand for grain, denoted as El $(D_g;P_g)$ and El $(D_g;Y)$, respectively.

In developed countries (DC), both of these elasticities are expected to be inelastic. This follows from the fact that per capita income (PCY) long ago reached a level which allowed the average member of the community to meet his/her basic nutritional needs. Hence, increases in PCY are increasingly expended upon non-food items. Aside from changes in PCY, increases in the level of population (POP) also have an impact on the demand for food within such markets. More specifically, it is expected that a given percentage change in population will be matched by a corresponding change in the quantity of grain demanded; that is, the population elasticity of demand for grain is assumed to be unity $(EL(D_g;POP) = 1.0)$.

Economic theory also suggests that the resulting price elasticity of demand for grain in DC's will be highly inelastic; this, once again, follows

from the fact that basic needs have been largely met. In other words, additional consumption of food brings rapidly diminishing marginal utility to the consumer.

The situation in the Less Developed Countries (LDC) is materially different; in this domain it is expected that the revealed price and income elasticities of demand for grain are much more elastic. The rationale for this view is as follows: since PCY levels are near the subsistence level, caloric intake is unlikely to have reached acceptable levels from either a health maintenance or a psychological perspective. Hence, a greater proportion of a rising PCY can be expected to be spent on food than in developed nations. Similarly, declining food prices, in such markets, should also result in a more elastic response in the quantity of food demanded than would occur in DC's.[4] On the other hand, it is anticipated that the $El(D_g;POP)$ will, as in the DC group, assume a value of roughly unity. Nevertheless, this variable is of much greater significance in LDC's, than in DC's, since the rate of growth of population in the former is two to three times that experienced in the latter.

In summary, it is herein suggested that the applicable income and price elasticities of demand for grain are highly inelastic in developed countries; the corresponding estimates in the LDC's are expected to be higher, perhaps reaching unity. Furthermore, it is postulated that population growth per se, will exert a larger influence on the demand for grain in the LDC's than in the DC's; this is attributable to higher population growth rates in the former group.

The above discussion, when viewed in conjunction with the fact that grain prices have been relatively stable over, say, the past 50 years[5] and

yet consumption has risen substantially over the same period, suggests that the long-run elasticity of supply must have been quite responsive to changing grain prices.[6] However, the primary explanation of stable food-stuff prices is that the grain industry has been subject to almost continuous technological change since the introduction of mechanization. The resulting impact has been to steadily shift the supply curve to the right which has largely offset demand shifts due to per capita income and population growth.

Let us now focus on the primary decision-maker in the demand for potash scenario - the farmer. It can be readily shown that profit maximizing farmers will employ potash up to the point where:[7] $P_g \cdot MPP_K = P_{K,FG}$.

Note that: P_g represents the price of grain; MPP_K represents the marginal physical product of potash; and $P_{K,FG}$ portrays the farm-gate price of potash. In lay terms, this relationship requires a profit maximizing farmer to utilize potash up to the point where the cost of the last unit employed equals the resulting incremental revenue. The latter term can be restated as the product of the price of grain (P_g) and the increase in output resulting in the use of one more tonne of potash (MPP_K). The price of grain is considered by some to be the primary influence on the demand for potash.[8] It operates in two ways: first, an increase in P_g should result in additional land being devoted to the production of grain; and second, an increase in P_g can also be expected to affect the quantity of K applied to existing grain-producing land. The aggregate change in K is difficult to determine a priori, but, nevertheless, two basic factors are at work. Assuming that K is the only input allowed to vary, it follows that a profit maximizing equilibrium can only be restored by increasing the use of K. This follows from the concept of diminishing marginal productivity: as more of a single

variable factor is applied to a set of fixed factors, the associated MPP must eventually decline. However, the magnitude of the change in K is critically dependent upon the shape of the MPP curve about the point of existing operation. If it declines steeply, then only a small change in K will be required to restore equilibrium; alternatively, a relatively flat curve will generate a substantial increase in potash applications. On the other hand, the actual effect of a change in P_g may be to alter the input ratios associated with the new level of output.[9] Hence, the final impact on the quantity of potash demanded depends, in part, on how input combinations change as output varies.

Furthermore, given the limited potential for substituting other inputs for K, it may be a reasonable working hypothesis to assume that a fixed proportion production function exists between K and all other inputs, for small changes in production. Hence, $El(D_K, P_g)$ cannot exceed the corresponding value of $El(D_g; P_g)$.[10] It then follows that the output price elasticity of demand for potash can be expected to be inelastic in the DC market and more elastic, perhaps approaching unity in the LDC domain.

Although this conclusion is based on a rather tenuous set of assumptions, it must be remembered that this relationship, although perhaps important in the short-term, may be of limited long-run relevance; this follows from the fact that the price of foodstuffs has been surprisingly constant over the last half century. However, it must be acknowledged that with a constantly growing world population, a slow but steady increase in per capita real income, and a highly inelastic supply of arable land, one might expect real food prices to rise in the future.[11] Hence, empirical work on estimating the output price elasticity of demand for potash in each market, is urgently required.

The equilibrium relationship, $P_g \cdot MPP_K = P_{K,FG}$, can also be employed to shed light on the impact of changing potash prices on demand for potash. For instance, if P_K increases, it is apparent that MPP_K must also increase and the use of K decrease in order to restore equilibrium. However, the actual adjustment process is, once again, more complex than a casual review of the equilibrium condition would suggest.[12] The first aspect can be denoted as a substitution effect: as P_K increases, it affects the relative ratio of input prices, and hence results in a new combination of inputs. The outcome can be expected to be a decrease in the utilization of K. However, the use of a larger quantity of "other" inputs will, in itself, increase MPP_K and, hence, facilitate the restoration of equilibrium at a higher level of output than if substitution between factors were not to occur. Mansfield has addressed this subject in the following manner:

> The more easily other inputs can be substituted for a certain input, say input x, the more price elastic is the demand for input x. ... But if these firms cannot substitute other inputs readily for input x, a large increase in the price of input x may result in only a small decrease in its use.[13]

Given that technical substitutes do not exist for soluble potassium, it is probable that the price elasticity of demand for potash will be quite inelastic.

The second impact of a change in P_K, denoted as the output effect, arises from the fact that as the price of any input changes, the profit-maximizing process must, in essence, be repeated. If P_K increases, the cost structure of the farmer shifts upwards; hence, one would expect less output to be produced and, thus, less potash to be employed. The prevailing industry view, obtained both from a review of the trade literature and personal interviews, is that from a potash firm's perspective, $El(D_K;P_K)$ is

highly inelastic in the DC market.[14] The corresponding figure for the LDC market is said to be much closer to unity. For example, Koepke, referring to a study by Hayes, states:

> Hayes presented statistical evidence for 1911-39 showing that fertilizer price changes had little effect on the volume of fertilizer sales and that potash price changes are not translated into fertilizer price changes (potash is the least costly of the three key ingredients for mixed fertilizers). The traditional viewpoint of an inelastic market demand curve has been challenged as being inapplicable for less developed nations; although no empirical evidence was presented to substantiate the challenge, the argument seems quite plausible since many sales are transacted on a total value basis as in the case of foreign aid tenders.[15]

Support for these reviews will now be presented. First, it must be remembered that the potash price referred to above is the farm-gate price; however, from a policy perspective, the relevant measure is the f.o.b. mine price. It is this price which is used in determining revenue to individual mines and to the industry as a whole. Unfortunately, the discrepancy between the farm-gate and f.o.b. mine price can be substantial. For example, in the U.S. market, transportation costs alone may be equivalent to 25% to 50% of the f.o.b. mine price.[16] Therefore, even abstracting from distributor mark-ups, it is apparent that the f.o.b. mine price elasticity of demand for potash $El(D_K;P_{K,M})$ is less elastic than that suggested by estimates of $El(D_K;P_{K,FG})$. Based on the above example, a 10% decline in $P_{K,M}$ will appear to the farmer as only a 5% to 7.5% change in $P_{K,FG}$.

In the off-shore market, the transportation charges are likely to represent an even larger portion of the farm-gate price.[17] Consequently, everything else being equal, the f.o.b. mine price elasticity for off-shore potash demand will be even less elastic than the corresponding figure in the domestic market.

Additional information exists which supports the contention that farm-gate and f.o.b. mine price elasticities differ materially. Hearsay evidence indicates that farmers, especially those resident in DC states, purchase fertilizer - not potash; indeed, it appears as if the relative proportions of N,K and P are quasi-fixed. The relevant ratio is primarily determined by local soil and crop-specific considerations. It is only for large changes in price that one should expect to see the type of fine-tuning suggested by neo-classical economics.

If this view is correct, it suggests that the discrepancy between the farm-gate price elasticity of demand for potash and the corresponding mine-specific estimate, will be even larger than that suggested previously. For example, if one assumes: that N,P and K are used in fixed and equal proportions; that $P_N = P_P = P_K$; and that transportation charges are equivalent to one-third of $P_{K,M}$; then it can readily be shown that $El(D_K;P_{K,M})$ will only be equal to 0.2 of the value of $El(D_K;P_F)$,[18] where P_F represents the farm-gate price of fertilizer.

The assumption of fixed proportions between N,P and K is less tenable in the LDC than DC setting. This follows from the fact that there is a greater tendency for the LDC farmer to apply potash directly to the soil. More specifically, since human and animal wastes are widely employed as sources of nitrogen, a relatively severe imbalance has developed between the recommended and actual ratios of P,N and K. Growing recognition of this situation is expected to result in a substantially larger proportion of each dollar of fertilizer expenditure being spent on potash in LDC's than in DC's. This also implies that it is the price of potash itself, not the price of blended fertilizer, which is the crucial variable in the decision calculus. There-

fore, it is reasonable to speculate that $El(D_K(domestic);P_{K,FG}) < El(D_K(off\text{-}shore); P_{K,FG})$.

To this point in the analysis, I have abstracted from the role of "time" in influencing the absolute value of elasticity estimates. This would normally be an important over-sight since, as Mansfield states: "the price elasticity of demand for an input is likely to be greater in the long-run than in the short-run ... Basically, the point is that it takes time to adjust fully to a price change."[19] In most instances, the adjustment occurs primarily through the substitution effect.

However, the situation in potash is quite different. There are no feasible technical substitutes for soluble potassium; hence the passing of time alone should not influence the optimum combinations of K,P and N. Furthermore, potash applications can be curtailed for a year or two without a material impact on crop yields, although it must then be followed by significant applications if productivity and quality are not to be materially affected.[20] Hence, a price increase for potash can be partially compensated for, in the short-term, by reducing utilization. This suggests that the long-run own price elasticity of potash is lower (more inelastic) than its short-run equivalent.

2.2.3 Institutional Issues

There are also non-economic reasons for assuming that the revealed f.o.b. mine price elasticity of demand is higher in the LDC than DC market. In the former, the decision-making process is frequently characterized by formalized state planning, and the allocation of foreign exchange by a central authority. For instance, it may be that the state wishes to increase domestic production of foodstuffs; if this occurs, demand for potash will

increase independently of any revealed change in food prices and/or GNP/capita. Similarly, liquidity issues may result in severe restrictions on imports (eg., Brazil). Thus, any attempt to model LDC demand for potash must grant due recognition to a host of non-market exogenous factors.

The role of foreign exchange restrictions deserves more attention. If, for example, a given quantity of foreign exchange is allocated for purposes of purchasing potash, then the revealed price elasticity should exhibit unitary value. This follows from the fact that the demand curve corresponds to a rectangular hyperbola: a 10% decline in price results in a 10% increase in quantity.

Other forms of regulation may be used by importing nations. For example, the central purchasing bureau may be instructed to follow a "buffer-stock" model. Under such a scheme, the agency, if it believes that prices are below the "expected" level, will increase purchases and the product will be either stock-piled or applied to the land. Alternatively, if price rises above the reference point, stocks are drawn down and, thereafter, K_2O applications curtailed until the reference price is once again attained or until it is readjusted to a higher level.

Both the foreign exchange and buffer stock models lead to higher price elasticity of demand estimates than that forthcoming from unregulated market models. Another institutional scenario that is of some relevance to the potash industry is that attributable to foreign aid purchases. From an economic perspective, such initiatives are similar to a fixed foreign exchange model. Budgetary allocations are normally made in advance of the purchase period and frequently specified in terms of a fixed dollar allocation. This leads to a unitary elasticity of demand with respect to price. In addition,

the crucial income variable is now probably that pertaining to the donor's economy more so than the recipients. Hence, aid purchases are most likely to be pro as opposed to anti-cyclical.

Institutional factors also operate in other ways. For instance, in many LDC's, the farm-gate price of foodstuffs is tightly controlled; in contrast to the situation in DC's, the prices are suppressed to below competitive market levels. Rephrased, the revealed price of foodstuffs lies well below its "true" shadow price. This situation has led developmental institutions such as the World Bank to propose removal of these impediments to efficiency. If this were to occur, it should result in an increase in the utilization of potash.[21] Similarly, recognition by central planners that the shadow price of foodstuffs exceeds the farm-gate price, should lead them to allocate more foreign exchange for the importation of potash and possibly to subsidize its usage.

2.2.4 Technological and Bureaucratic Issues

To this point, I have largely ignored the role of technology. In order to deal with this subject in some depth, I shall sub-divide the analysis into two parts: the diffusion of knowledge and bureaucratic constraints. In the DC's, changing agrarian technology has led to a substantial increase in the application of commercial fertilizers, independently of agricultural prices and national income considerations. Nevertheless, even here, agronomists and agricultural economists suggest that crop yields could be increased substantially over their present levels through the application of fertilizers.

However, this will only come to pass if the decision-makers, the farmers, accept the "knowledge" that it is in their best interests to apply fertilizers more intensively. This is most likely to occur through such

vehicles as agricultural extension services and demonstration programs. Indeed, much of the growth in potash consumption over the past 20 or 30 years, especially in the DC market, can probably be attributed to increased knowledge of the role of potash, and to technological change.

The technology argument is probably even more important in LDC's than in DC's. Although one might suggest that, as previously discussed, rather "low" farm-gate prices for foodstuffs have resulted in less intensive use of potash than would have occurred if the farm-gate price had been allowed to attain its competitive level, the so-called "under-utilization" of potash is obviously due, in part, to a host of other factors. By this statement I mean that fertilizer usage, especially that of potash, is substantially less than that suggested by profit-maximizing behaviour, given available technology and prevailing output prices.

The reasons for this "gap" in fertilizer application can be attributed to two primary factors: ignorance, on the part of farmers, and institutional constraints. With respect to the former, the issues are as follows. It is apparent that in many settings, farmers are unaware or unconvinced of the virtues of additional fertilizer application. For example, in some societies, quasi-religious and cultural factors dictate planting and harvesting technology. In others, the phenomenon may be attributable to a lack of exposure to concrete evidence.

To overcome these problems, high quality agricultural extension work and numerous demonstration projects are required. Closely associated with this approach is the general issue of rural literacy. As more and more farmers acquire at least a primary school education, there is a higher probability that the information conveyed by both agricultural educators and pilot projects will be adopted for wide-spread use.

The agricultural development literature suggests that at least equal weight should be placed on schemes which attempt to remove bureaucratic constraints to the utilization of potash in socially optimum quantities. That is, government policies frequently act so as to restrict both the rate of diffusion of knowledge and, more importantly, to virtually preclude changes in current agricultural methods. One of the most pervasive problems in this area, is the limited availability of agricultural credit facilities to help farmers purchase potash, quality seeds and the remaining inputs associated with "appropriate" technology.

A second problem is said to be the quality and quantity of rural-based agricultural extension workers. Although largely an educational problem, its rectification requires incremental funding in order to provide proper training, recruitment and retention of staff, and the provision of complementary inputs. Third, if rural distribution and storage systems were upgraded, the consumption of potash would most likely increase. Although such improvements would help reduce the farm-gate price of potash, they would be more important in increasing markets for agricultural produce and hence, indirectly, increasing the demand for potash.

The last issue to be considered under the bureaucratic constraint label has two constituent elements. The first relates to the role of economic planning. More specifically, not only must farmers be aware of the optimum quantity of potash use consistent with economic efficiency, but so must the politicians and bureaucrats in those countries which rely heavily on non-market systems in the agricultural sector. For example, under strict state planning regimes, potash production and/or its importation may be specified in quantitative terms. For this approach to work properly, the planners must possess adequate knowledge of the role of fertilizers in the food production

process; it is not clear that this is the norm. Furthermore, even in those domains where the market system is largely relied upon for internal distribution, restrictions on the allocation of foreign exchange may severely retard the ability of farmers to obtain the desired quantities of potash. The problem here is identical to that described above: the planners must know the shadow-price of potash in local use in order to provide for sufficient foreign exchange consistent with efficient production of foodstuffs. Once again, there is wide-spread concern that the implicit shadow price employed in this process differs substantially from the "real" shadow price for potash.

2.2.5 Summary

In this section, I have attempted to address the basic elements of the demand for potash. More specifically, it is suggested that the price and income elasticities of demand for potash intensive crops are highly inelastic in the DC market. The corresponding estimates are expected to be materially higher (more elastic) in the LDC group. In terms of the derived demand curve for potash, it is herein suggested that the output price elasticity of demand for potash should be closely related to the elasticity of the market demand curve for potash intensive crops. Hence, one might also expect the output price elasticity of demand for potash to generally follow the pattern denoted above: relatively inelastic in the DC market and much less so in the LDC's. Indeed, in the latter domain, the relevant elasticity estimates may approach and even exceed unity.

The analysis suggests that even more important than the traditional economic variables of price and income is the role played by technological and institutional factors. Although some scope is seen for increasing the use of

potash in developed economies through institution of best-practice technology consistent with economic efficiency, the potential in LDC's is substantial. Rephrased, the analysis strongly supports the view of most potash industry officials that the future growth markets, both in percentage and absolute terms, lie in the LDC's.

However, even here, the wisdom of utilizing price competition to increase Saskatchewan's market is unclear since so little is known about the actual demand elasticities for potash. Nevertheless, casual empiricism suggests that the LDC markets will increase substantially over time due to rising population and per capita incomes. Even more important will be the effects on market demand of the expected continuation, over time, of the diffusion of knowledge to both farmers and bureaucrats. Fortunately, it is in this area that the Government of Canada, the Saskatchewan-based producers, and perhaps even the Saskatchewan government, can affect policy outcomes. For instance, one or more of these agents may provide the funding for demonstration projects and provide for generous (reasonable) credit schemes to facilitate potash sales throughout the Third World.

In concluding, it must be stressed that although the suppositions provided in this section are consistent with the views expounded in the potash trade literature, the results must still be viewed with a healthy degree of skepticism. This stems from the paucity of supporting documentation. For example, my literature search revealed numerous references to the "low" price elasticity of demand for potash; however, almost invariably, no empirical estimates were supplied either directly or indirectly through references to source documents. This suggests that the first stage of any policy review should be the initiation of a research programme to independently estimate the applicable elasticities for each major market.

2.3 Supply Characteristics

2.3.1 General Issues

From the information displayed in Tables 4 to 6, it is apparent that Canada is a major actor in the potash industry: for instance, in 1980 Saskatchewan-based mines produced 26.7% of output; possessed 25.2% of productive capacity, and held 40% of the world's export market. Equally clear from the data is the significant role played by the U.S.S.R. and to a lesser extent, East Germany. These three nations account for 67, 67 and 78% of the world's production, capacity, and exports, respectively. Hence, it is virtually impossible to draw any conclusion but that the sellers market for potash is potentially oligopolistic. This observation is reinforced by the fact that, with the exception of the U.S. market, each exporting nation utilizes a single selling agency. For example, Saskatchewan producers are represented by the Canadian Potash Exporters Association (Canpotex) in all but the U.S. market.

As noted in Chapter 1, the Saskatchewan producers possess the world's largest and highest quality reserves. Despite being located at great depth, they yield the world's lowest cost output. Although general statements in support of this proposition abound, specific estimates are difficult to obtain. For this reason I am forced to rely on the outdated but thorough work of Keopke.[22] As shown in Table 7, he found that, in 1967, Saskatchewan producers possessed a substantial operating cost advantage over all other competitors.[23] Further support is provided by Energy, Mines and Resources Canada:

> The exceptionally high grade of Canadian deposits (25 to 30 percent K_2O) gives them the lowest operating costs in the world. For example, direct operating costs (1978) in Saskatchewan mines are about $14 to $16 per t KCL com-

TABLE 4

World Potash Capacity 1962-1982
(million metric tons, K_2O equivalent)

	1962	1966	1969	1975	1979	1982
U.S.S.R.	1.5	2.6	4.0	8.1	10.0	11.3
Canada	0.2	1.7	6.1	7.5	8.0	8.7
East Germany	1.7	2.0	2.4	3.2	3.4	3.6
West Germany	2.0	2.4	2.4	2.8	2.9	2.9
U.S.A.	2.3	3.6	3.7	3.1	2.4	2.4
France	1.7	1.9	1.9	2.3	2.2	2.0
Spain	-	-	-	0.7	0.8	0.8
Israel	-	-	-	0.7	0.7	1.0
U.K.	-	-	-	-	0.6	0.4
Italy	-	-	-	-	0.2	0.4
Others	0.4	0.9	1.5	0.3	0.4	0.1
TOTAL	9.8	15.1	22.0	28.7	31.8	33.4

Source: Derived from U.S. Bureau of Mines, The United States Position and Outlook in Potash (Washington: Department of the Interior, 1970), p. 11; Joseph Kruger and Neil Thurston, "A Study of Factors Affecting the Marketing and Transportation of Potash", Freight Study #30-78-04, Canadian Trasnport Commission, Ottawa, July 1978, p. 1; Energy, Mines and Resources Canada, Potash: A Proposed Strategy (Ottawa: Supply and Services Canada, 1982), p. 11; and George Barry, "Potash", Canadian Minerals Yearbook 1982 (Ottawa: Supply and Services, 1983), p. 31.11.

TABLE 5

World Potash Production 1962-1982
(million metric tons, K_2O equivalent)

	1962	1966	1969	1975	1979	1980	1982
U.S.S.R.	1.33	2.63	3.24	8.00	6.64	8.06	9.00
Canada	0.14	1.82	3.40	5.50	7.07	7.53	5.20
East Germany	1.65	2.00	2.35	3.10	3.40	3.42	3.50
West Germany	1.94	2.29	2.28	2.30	2.62	2.74	2.60
U.S.A.	2.22	3.01	2.54	2.30	2.23	2.24	1.78
France	1.72	1.78	1.79	1.90	1.92	1.89	1.82
Spain	0.23	0.42	0.55	0.60	0.67	0.66	0.75
Israel	0.09	0.31	0.36	0.60	0.73	0.80	1.00
U.K.	-	-	-	-	0.18	0.32	0.40
Italy	0.11	0.18	0.18	0.18	0.18	0.16	0.12
Others	-	-	-	0.12	0.38	0.35	0.57
TOTAL	9.43	14.47	16.84	24.60	26.02	28.17	26.74

Source: Derived from W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry (Ottawa: Information Canada, 1973), p. 60; Joseph Kruger and Neil Thurston, "A Study of Factors Affecting the Marketing and Transportation of Potash", Freight Study #30-78-04, Canadian Transport Commission, Ottawa, July 78, p. 1; and James P. Searls, "Potash", U.S. Minerals Yearbook 1982 (Washington: U.S. Bureau of Mines, 1983), p. 13.

TABLE 6

World Potash Trade 1981
('000 tonnes K_2O)

IMPORTING REGIONS	EXPORTING REGIONS											
	Belgium	France	W.Germany	Italy	Spain	UK	GDR	USSR	Canada	USA	Israel	Total
W. Europe	184.9	179.0	845.4	1.0	191.2	38.8	679.4	447.7	10.9	13.7	174.2	2,766.1
E. Europe	-	-	24.5	2.9	-	-	1,213.6	2,111.8	-	-	-	3,352.7
Africa	28.7	2.4	51.0	15.7	60.3	-	15.5	9.5	43.4	3.4	96.5	327.3
N. America	5.8	-	13.6	-	17.3	0.2	55.1	7.7	4,182.0	18.6	219.7	4,520.0
C. America	2.0	0.4	20.3	-	18.7	-	107.9	100.4	48.6	69.1	-	367.3
S. America	7.8	6.3	75.0	-	38.1	7.5	268.8	53.1	250.6	180.4	25.3	913.0
Asia	61.5	23.4	298.7	5.0	33.8	7.5	430.9	266.6	1,356.4	139.4	70.9	2,700.6
Aus. & Oceania	0.5	-	0.6	-	-	-	-	7.3	112.6	96.1	-	218.6
WORLD TOTAL	291.3	211.4	1,328.9	24.6	359.4	54.0	2,771.2	3,004.1	6,004.6	520.6	568.5	15,165.5

Source: British Sulphur Institute, Client Study, 1983.

TABLE 7

Estimated Production Costs for 'Typical' Potash Mines in Some Major Producing Countries and Transportation and Handling Costs to Ports of Export, 1967

Country and Origin of Potash	Ore Grade	Production Costs			Transportation and Handling Costs	Total Cost fob Port of Export	Port of Export
		Operating	Invisibles	Total			
	(K_2O)	$ per short ton 60% KCL					
Canada (Sask.)	25	8.27	5.74	14.01	10.20	24.21	Vancouver, B.C.
United States (New Mexico)	18	15.00	3.23	18.23	10.37	28.60	Houston, Texas
					10.58	28.81	Long Beach, Cal.
Spain (Catalonia & Navarra)	16	17.50	3.76	21.26	2.22	23.48	Pasajes, Bay of Biscay
					2.22	23.48	Barcelona, Mediterranean
France	17	18.00	2.34	20.34	5.98	26.32	Antwerp, Belgium
West Germany	12	21.00	3.15	24.15	5.20	29.35	Hamburg & Bremen
Isreal (Dead Sea)	brine	n.a.	n.a.	22.43	2.77	25.20	Asdod, Mediterranean
					3.10	25.53	Eilat, Red Sea

Source: W.F. Koepke, Structure, Behaviour and Performance of the World Potash Industry (Ottawa: Information Canada, 1973), p. 18.

a) This category (invisibles) represents the sum of "allowances or payments for depreciation, amortization, interest and sales and administration" (Koepke, op.cit., p. 19).

> pared with $22 to $24 in the United States. Operating costs in Europe are more than double the Canadian levels.[24]

However, as also shown in Table 7, once financial charges are taken into consideration, the differential narrows somewhat.

In summary, it is apparent that Saskatchewan producers enjoy a f.o.b. mine price advantage over their competitors. However, one important factor has been ignored to date which is a critical determinant of competitiveness: transportation charges. Once they are included, the Saskatchewan operator's cost advantage largely disappears in many markets.[25]

Let us first focus on the off-shore market which includes all potential purchasers save those in Canada and the United States. The effective price paid by an off-shore importer consists of three components: f.o.b. mine price; mine to domestic port charges; and sea-freight to foreign port. Information on the first component was presented above; it should suffice to note that Saskatchewan producers are thought to be the lowest cost suppliers in the world. However, these same producers are at a distinct disadvantage with respect to rail costs to their port of export. For instance, it costs approximately $26 to ship a tonne of KCL from Saskatoon to Vancouver.[26] In contrast, the New Brunswick operators face an $4 charge; corresponding rates applicable to Israeli, Jordonian and East German exporters are $8, $6 and $17/t KCL.[27] Such differentials go a long way towards offsetting production cost advantages. Sea-freight charges, which constitute the third element, are shown in Table 8. Although Saskatchewan producers do not enjoy any obvious location advantages, they appear to be in a reasonably competitive position.

In summary, the major disadvantage possessed by Saskatchewan producers is the heavy inland rail charges that they must incur in moving their product

TABLE 8

Sea-Freight: Cost per Tonne KCL Delivered, 1982

Discharge Port	Vancouver	Ventspils	Illychevsk	Hamburg	Wismar	Israel	St. Johns	Aqaba
U.S. East Coast	-	11.57	-	8.47	10.30	8.97	2.99	11.77
Brazil	14.05	17.66	-	12.93	15.69	12.88	9.67	11.03
India	26.83	30.97	21.38	24.84	28.71	17.31	25.28	11.37
South Africa	12.31	-	-	-	-	12.04	-	7.71
China	18.73	-	26.06	-	-	-	-	14.93
North-west Europe	12.45	-	-	-	-	-	7.37	-

Source: British Sulphur Institute, Client Study, 1983.

to port. Despite an overall competitive disadvantage in regard to freight-rates, the problems facing Saskatchewan operators may be less severe than that suggested by the above comments. First, the Israeli and Jordanian suppliers may face supply constraints; in other words, they may not be able to expand production to take advantage of growing markets due to the limited reserve capacity of the Dead Sea.[28] Second, the major growth markets, at least in a relative sense, are expected to be in China, India and Brazil. For these markets, Saskatchewan producers appear to be reasonably competitive from a sea-freight perspective. Third, the Port of Vancouver is relatively efficient and its existing capacity is twice that of its current annual throughput.[29]

Saskatchewan producers have generally enjoyed a locational advantage in the U.S. mid-west which constitutes the province's major market.[30] Given that "the traditional policy of the railways has been to price at a level equal to the rate level from Carlsbad, New Mexico, into the major consuming American states",[31] Saskatchewan producers are able to compete successfully against U.S. producers throughout much of the U.S.A. For example, Koepke states that:

> Equalized freight rates gave Saskatchewan a comparative advantage in most key outlets in North America; in a speech before the Senate in Washington in October 1967, the Senator from New Mexico stated that " the only three states in the United States where New Mexico potash can compete pricewise with Canadian imports are the states of New Mexico itself, Texas and Oklahoma. All other 47 states can acquire their potash cheaper from Canadian sources."[32]

Although deregulation of freight rates has changed the situation somewhat, the competitive position of U.S. producers vis a vis their Canadian counterparts remains as described above. Nevertheless, Saskatchewan's

traditional markets are threatened somewhat by the new New Brunswick producers. They will capture the fringe market along the U.S. east coast but their freight rate advantages to, say, the U.S. mid-west, are not likely to offset their operating cost differential. On the other hand, Saskatchewan producers appear to be expressing growing concern over the aggressive sales behaviour of Israeli operators. Potash from this country is now being barged up the Mississippi River to strike at the very heart of the Saskatchewan producers' traditional markets. This is largely attributable to changes in recent years in sea versus land freight rates and, to some extent, possible dumping activities.

As a consequence of the slow-down in the world economy since, say, 1980, sea rates have declined substantially. Although the railways have responded to some degree, the relative costs of sea-freight have fallen substantially more. Hence, those producers located close to ocean ports have improved their competitive positions. Before one accepts the view that Saskatchewan producers have lost their competitive position in the U.S. market, it should be noted that the Israeli penetration may be transitory. As the world economy rebounds, sea-freight rates should increase substantially as ship-owners attempt to cover materially more than their variable costs. Furthermore, part of the Israeli success is said to be due to the pursuit of foreign exchange earning objectives. Due to their balance of payments difficulties, the state owned mines may be selling potash at a significant accounting loss. While such practices may continue, it is unlikely that incremental capacity could be justified if such pricing policies remain in place.

The time and resource limitations placed on this study preclude a more detailed examination of transportation charges to the U.S. market. This is a potentially serious limitation since it appears as if the U.S. movement

towards deregulation has made the available literature largely irrelevant from a policy perspective. Hence, further work must be undertaken in order to properly estimate future Saskatchewan sales to the U.S.A.

It should be noted that the industry's cost structure is highly capital intensive and, hence, financial charges represent the dominant component of average total unit cost (ATC) at almost every level of capacity utilization. For example, Sheldrick's model, based on a constant variable unit cost, suggests that fixed costs constitute 86, 75 and 71% of ATC at utilization rates of 60, 80 and 100%, respectively.

This is an important result for policy formulation purposes. For example, it implies that once a mine is constructed, it will be extremely difficult to drive out of operation, even by means of sustained predatory pricing. The argument is based on the following elements.[33] Since short-run marginal cost (MC) is assumed to be a constant, the total average cost schedule declines continuously over the relevant range of operation; this follows from the fact that fixed costs are spread over an increasing volume of output. Given that a profit maximizing oligopolist will operate at the point where marginal revenue (MR) equals MC (MR = MC), it can be seen that such a firm may incur substantial losses over a rather lengthy period of time.

In practice, this statement must be qualified by the introduction of a cash-flow constraint: if relatively new mines are heavily debt financed, it is possible that their total revenue may be insufficient to cover total operating costs and debt servicing outlays. If so, mine closures may occur sooner than the prior analysis suggests.[34] Nevertheless, once a mine enters production, it will continue to operate, notwithstanding the presence of substantial accounting losses, over the entire physical life of the project.

This result is of relevance to all existing producers since, in an oligopolistic market, the output of any one operator has an impact on market price. Thus, an ill-advised expansion not only generates losses for the project's investors, but for existing investors as well. The above described phenomenon is sometimes denoted as destructive competition; since it is a form of market failure, it warrants possible intervention by government. Such policies will be addressed in Chapter 4.

In addition, the industry's cost structure suggests that if interaction effects between operators are ignored, then it is in every participants interest to operate as close to full capacity as is possible. That is, as long as expected MR exceeds MC, the firm will minimize losses by expanding production. Unfortunately, if all producers respond in this manner, in the presence of an industry-wide inelastic demand curve, most will be worse off than they were before initiation of the price-cutting exercise.[35] Once again, this issue will be explored in depth in Chapter 4; suffice it to say here that the industry's health may only be preserved in troubled times by a great deal of collective self-restraint or through governmental activity.

Additional supply-side comments are in order. An important factor in any discussion of appropriate pricing and expansion planning is the nature of the industry's short and long-run supply elasticities. Obviously, if unused capacity is available for exploitation, supply should be quite responsive to a change in price. However, once excess capacity has been utilized, the short-term elasticity is most likely to be exceedingly low. It takes approximately 1.5 to 3 years to complete a major expansion project and about 5 years to bring a new mine into production.

The long-run supply elasticities, which encompass the above noted expansions and new mines construction, are undoubtedly higher. However, the key

question of "how much so" is difficult to answer. Empirical evidence is lacking but casual empiricism allows one to make some preliminary judgements. It is generally conceded that, with the exception of those in Canada and the U.S.S.R., the development of known deposits are expected to result in relatively high cost operations. Hence, the bulk of medium term expansion is expected to take place in Canada and the U.S.S.R.[36]

2.3.2 The Long-Run Supply Curve: Theoretical and Policy Issues

Let us now explore the shape of the long-run supply curve. For small changes in excess of the current production levels, the supply curve should be almost infinitely elastic. This is attributable to the substantial amount of excess capacity presently available within the system - much of it in Saskatchewan. As capacity constraints become operational, prices should rise from the present level of approximately \$110/tK_2O (1982 constant prices) to roughly \$120 to \$140/tK_2O (f.o.b. mine, Sask.) before additional expansion is called forth.[37,38] Of course, short-term price variations may be substantial due to the 18-36 month gestation period associated with major expansions of existing operations.

More specifically, it is suggested by industry officials that such expansions could be undertaken for 60-70% of the corresponding cost of an equivalent increment in capacity achieved through new mine construction. Fortunately, possibly four of five of the existing Saskatchewan-based mines are candidates for such "cheap" incremental investment; this could result in 3 to 4 million tonnes of incremental capacity. Although expansions of this type are probably available elsewhere in the world, they are not expected to be of major significance.

After the existing slack has been utilized and the available "cheap" incremental expansion has been exploited, incremental output must be obtained

through the construction of new mines. According to Sheldrick,[39] the long-term f.o.b. mine (Saskatchewan) price of potash must be expected to lie in the \$140 to \$170/tK_2O range (1982 prices) in order to justify the construction of a medium sized mine in Saskatchewan. This information, when coupled with the previously stated industry view that major expansions of the industry will largely take place in Canada and the U.S.S.R., suggests that higher prices, probably in the \$170 - \$200 (f.o.b. mine, Sask.) range, are required to elicit new capacity in other domains.

Given the massive, uniform reserve base, in both Canada and the U.S.S.R., the long-term supply curve should be relatively elastic over virtually all conceivable output ranges, for prices in excess of \$140 - \$170/tK_2O. However, transportation problems could act to reduce the ability of either or both countries to supply such incremental output to customers. Furthermore, the supply response of the U.S.S.R. is difficult to predict. First, little is known about its "true" cost structure. Second, transportation problems are said by some to severely limit the U.S.S.R.'s supply capability. Third, domestic objectives, both within the U.S.S.R. and the other Comecom members, generally take priority over export sales. For these reasons, the export supply curve may differ materially from the corresponding global construct. Any such deviation obviously works to Saskatchewan's advantage.

Finally, it should be noted that, for policy purposes, one should estimate the long-term supply curve with and without Canadian and U.S.S.R. participation. In the former situation, we obtain the step-function discussed above which is characterized by a highly elastic supply response for prices in excess of those required to bring forth new mines - approximately \$140 -

$170/t$K_2O$ (f.o.b. mine, Sask.). I shall denote this relationship as the "global" supply curve.

On the other hand, if both Canada and the U.S.S.R. are excluded, the "adjusted" supply curve should be considerably less elastic than the global curve. Although the actual elasticity estimates are unknown, it can safely be said that the curve should be relatively inelastic until selling prices reach approximately $180 to $200/t$K_2O$ (f.o.b. mine, Sask.), eg., the price necessary to call forth significant incremental capacity outside of the U.S.S.R. and Canada.

These two supply curves are important for policy formulation purposes. The global curve suggests that although some rent potential exists for Saskatchewan claimants, the quantity available could be minimal unless restrictive entry or output policies are practiced. Restated, this means that since Saskatchewan alone has the ability to supply the world's long-term supply needs at approximately constant cost, unrestricted access to its deposits will result in additional mines being built up to the point where only normal profits will be earned on all so-called "new" mines.[40]

On the other hand, if judicious output expansion takes place, the potential exists for the province to capture a significant amount of rent. This statement requires elaboration. Although transportation costs, non-tariff barriers to trade and new discoveries of "rich" ore bodies will almost invariably result in some non-Saskatchewan expansion, it is possible for the province, either through informal or formal arrangements between producers or through government (provincial and/or federal) initiatives to control expansion so as to keep the expected future price below the threshold required to bring forth economically viable expansions elsewhere. This is important for

the reasons noted previously: once constructed, it is virtually impossible to drive new competition out of the market; and once in operation, they will reduce the profits of all existing operators - perhaps to the point where all rents are squandered. Hence, shifts in demand must be met, if necessary, by appropriate expansions of supply by Saskatchewan producers in order to pre-empt construction in other domains.[41]

In general terms, and assuming the price elasticity of demand for potash to be highly inelastic, a supply management scheme could be instituted with the following general properties. With the proviso that construction lags would be recognized, capacity expansions would not be permitted until the prevailing excess capacity was utilized. Then, as prices increased, or were expected to do so, to the \$120 - \$140/tK_2O (f.o.b. mine, Sask., 1982 prices) range, so-called "cheap" incremental expansion would be encouraged - in an orderly fashion of course. However, when expected prices reached the level required to justify new mines, expansion should be initially resisted, since substantial rents could then be earned on the existing and "cheap" incremental expansion activities. However, in order to prevent short-term prices from rising too high and hence giving rise to expectations of long-term prices which would make new facilities viable in other domains, new mines should be initiated in Saskatchewan. Such a policy would allow new mines to earn some rents, and for prior investments to reap substantial benefits.

This discussion is rather simplistic since the optimal strategy must take into account the long-term, industry-wide, profit-maximizing strategy. Given that: demand is not perfectly inelastic; the U.S.S.R.'s supply response has been ignored; the role of transportation costs is more complex than that implicitly assumed herein; and that some output expansion will occur else-

where even if it cannot be justified on the basis of private-sector investment criteria, the above analysis represents an overly optimistic and artificial view of reality. Nevertheless, it does represent the essence of supply management policy. The overall message is that the richness and uniformity of Saskatchewan potash deposits are a mixed blessing: if properly managed, they are capable of generating substantial on-going rents; if mis-managed, they are capable of sustaining policies which could result in a squandering of the potential rents.

2.4 World Trade in Potash

In 1981, the world trade in potash amounted to 15.2 million t K_2O. As shown in Table 6, Canada accounted for 40% of world exports - double the share of its closest competitor, the U.S.S.R. From Tables 9 and 10, it is apparent that Canadian trade is heavily concentrated on the U.S. market - approximately two-thirds of Saskatchewan's annual output. In contrast, the next two largest customers, China and Japan, take less than 10% of the amount exported to the U.S.

As one would expect for a commodity characterized by low elasticities in both the demand and supply markets, (the short-run only) price tends to fluctuate rather sharply. As shown in Table 11, even after adjusting for the effects of inflation, average selling price ranged from \$97 to \$174/t K_2O over the past decade. Of current interest is the fact that prices fell by 31% between 1981 and 1982 and a further 17% between 1982 and 1983.

The data displayed in Table 11 also indicate that the selling prices received by Canadian producers in the off-shore and U.S. markets have varied significantly over time. In periods of weak markets, the U.S. price exceeds the corresponding off-shore charge; and in tight market conditions, the

TABLE 9

Canada, Potash Exports, Selected Years 1965-1982
('000s metric tons KCL; current year prices)

Importer	1970 ('000 tonnes)	1970 (million $)	1975 ('000 tonnes)	1975 (million $)	1980 ('000 tonnes)	1980 (million $)	1981 ('000 tonnes)	1981 (million $)
United States	3,852	93.30	5,374	236.67	7,141	596.85	6,797	647.4
China	-	-	129	2.89	347	37.42	552	61.61
Japan	550	14.03	585	17.06	630	61.82	530	61.57
Singapore	26	0.70	62	1.40	263	27.89	434	47.02
Brazil	-	-	216	5.52	788	81.02	406	45.70
South Korea	71	1.41	346	10.54	238	25.43	376	42.77
India	128	3.31	104	4.51	490	50.90	350	39.58
Australia	39	0.87	95	3.53	188	18.30	182	21.41
Taiwan	-	-	55	1.60	167	16.23	143	14.04
Mexico	-	-					82	9.27
Others	309	7.68	292	8.48	286	30.31	215	24.66
TOTAL	4,975	121.31	7,258	292.20	10,538	946.09	10,068	1,014.97

Source: Energy, Mines and Resources Canada, "Potash", Canadian Minerals Yearbook (Ottawa: Supply and Services, Various Years).

TABLE 10

Canadian Potash Sales to the United States

Year	Canadian Exports to U.S. ('000 tonnes K_2O)	Can. Exports to U.S. as a % of total U.S. Imports	Can. Exports to U.S. as a % of U.S. Consumption	Can. Exports to U.S. as a % of Total Can. Production	Ratio of U.S. to Off-Shore Prices (f.o.b. mine) [a]
64	368.5	63.9	14.8	47.3	NA
65	609.5	78.8	23.7	41.5	NA
66	1,022.0	86.3	34.9	56.2	NA
67	1,206.2	84.6	50.2	51.5	NA
68	1,760.1	88.3	51.0	62.9	NA
69	1,626.7	92.7	46.0	47.8	NA
70	2,376.8	98.2	64.8	74.9	0.967
71	2,213.0	97.3	57.5	61.9	1.010
72	2,715.1	96.7	68.9	69.9	0.955
73	2,796.5	96.4	69.7	65.8	0.972
74	3,728.5	99.7	87.3	68.0	1.558
75	3,339.5	95.0	NA	61.0	1.490
76	3,502.9	98.0	NA	70.1	0.867
77	4,386.1	96.6	NA	72.0	0.967
78	4,370.3	96.3	NA	71.4	1.008
79	4,399.2	94.7	78.1	65.5	0.933
80	4,746.7	94.6	83.8	63.0	0.810
81	4,537.0	93.6	80.1	63.5	0.847
82	3,240.5	91.0	69.8	62.2	1.27
83	NA	NA	NA	NA	1.34

Sources: United States Bureau of Mines, "Potash", Mineral Yearbook (Washington: Dept. of the Interior, Various Years) ; Energy, Mines and Resources Canada, Canadian Minerals Yearbook (Ottawa: Supply and Services Canada, Various Years); and Table 11.

[a] Derived from Table 11: division of column (2) by column (1).

TABLE 11

Selling Price of Saskatchewan Potash
($ per tonne K_2O, f.o.b. mine)

Calendar Year	Current Year Prices			1982 Constant $ Price: Total Exports[a,b]
	Off-Shore	U.S.A.	Total Exports	
1970	40.31	38.96	39.28	110.85
1971	41.71	42.20	42.04	114.60
1972	42.63	40.97	41.19	106.93
1973	42.31	41.12	41.44	98.58
1974	35.19	54.83	48.97	101.07
1975	47.57	70.89	64.85	120.82
1976	88.74	76.91	79.24	134.87
1977	83.98	81.19	81.77	130.01
1978	84.45	84.72	84.65	126.38
1979	114.57	106.94	109.05	147.65
1980	165.41	134.01	144.51	176.16
1981	180.95	153.29	162.25	179.61
1982	106.00[c]	135.00[c]	126.00	125.00
1983	85.00[c]	114.10[c]	105.00[c]	100.00

Source: Energy, Mines and Resources Canada, "Potash", Canadian Minerals Yearbook (Ottawa: Supply and Services Canada, Various Years).

a Based on Gross National Expenditure Implicit Price Index (Source: Statistics Canada).

b Note that the 1982 constant dollar prices listed on this table differ somewhat from those reported on Table 13. The differences are generally attributable to discrepancies between Statistics Canada data (this table) and that of the Saskatchewan Department of Energy and Mines (Table 13). Given time limitations and the limited relevance of the problem to this study, no attempt was made to resolve the issue.

c Estimates based on information obtained from government and industry sources.

reverse holds. More specially, in 1974 as the prorationing system was terminated but the mines were still operating at approximately 70% of capacity, off-shore prices were revealed to lie well below the domestic levy. In the late 1970's and early 1980's, the reverse occurred, with the off-shore product selling at a significant premium. However, with the collapse of the market in late 1981, the situation once again reversed itself; for instance, it is reported that in mid-1983, sales f.o.b. mine to off-shore markets were being made for \$80-90/t K_2O in contrast to an average domestic price of approximately \$105/t K_2O.[42]

This information supports the proposition that Saskatchewan producers already act to some extent, as a price discriminating monopolist. They clearly perceive the U.S. and off-shore market to be economically distinct and appear to follow different pricing policies in each. This issue will be discussed in greater depth in Chapter 4.

2.5 The Potash Industry and the Saskatchewan Economy

By 1970, as shown in Table 12, ten mines had been constructed in Saskatchewan at a cost of \$684 million (\$2,104 million in 1982 constant prices); they originally possessed a potential output of 7.57 million t K_2O which has been increased in recent years to its present level of 8.7 million t K_2O. However, as shown in Table 13, the available capacity has generally been massively under-utilized - at least until the late 1970's. Nevertheless, Saskatchewan slowly increased its share of world output until, by 1979, it reached 26%. However, the current recession has, as have past industry slowdowns, hit Saskatchewan disproportionately hard - the province is clearly a residual supplier. This is demonstrated by the fact that, as shown in Table 5, Saskatchewan's share of world output declined from 26.0% to 20% between

TABLE 12

Selected Characteristics of Saskatchewan Potash Mines as Initially Constructed

Company	Initial Production	Theoretical Productive Capacity ('000 metric tons K_2O)	Average Ore Grade (% K_2O)	Average Height of Cut (feet)	Depth of Operations (feet)	Approximate Initial Investment: Historical Cost ($ million)	Approximate [a] Initial Investment: 1982 Constant Prices ($ million)
International Minerals and Chemical Corporation (K1)	1962	1,165	2.54	8	3,132	65	232
(K2)	1967	955				60	182
Kalium Chemicals Limited	1964	852	-	-	-	60	202
Potash Company of America	1965	418	27.0	11	3,300	63	235
APM Operators Ltd.	1968	830	26.0	11	3,700	80	241
Alurnsal Potash of Canada	1968	545	22.8	11	3,300	60	181
Duval Corporation of Canada	1968	665	25.5	11	3,315	63	190
Cominco	1969	655	25.4	10.5	3,526	65	189
Central Canada Potash Co. Ltd.	1969	818	26.5	11	3,350	89	259
Hudson Bay Mining and Smelting	1970	665	22.5	8	3,150	79	194
TOTAL		7,567				1,324	2,104

Source: June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan, Unpublished Ph.D. Thesis, University of Toronto, 1982, p. 339; and John Richards, Primary Industry and Regional Development: Potash in Saskatchewan, Unpublished Ph.D. Thesis, Washington University, St. Louis, 1982, p. 254b.

[a] Richards' 1977 constant dollar estimates are rescaled to 1982 prices by utilizing the Gross National Expenditure Implicit Price Index (Source: Statistics Canada).

1981 and 1982 - a transition period from boom to gloom within the industry. Rephrased, during the recent industry slump, Saskatchewan has absorbed virtually all of the decline in world consumption.[43]

The data in Table 13 demonstrates the importance of the potash industry to Saskatchewan. For instance, in 1980, the industry sold over $1 billion of product; produced 7.3 million tK_2O which represented approximately 92% of capacity; and directly employed 4,160 people. Since then, as noted above, the industry has encountered difficult times, but there are indications (as at October 1983) that a major recovery is underway.[44]

In terms of sales revenue, potash is one of Canada's major non-petroleum minerals: in 1981, it ranked 5th in terms of value of production - ahead of coal and gold.[45] Its position in terms of export sales is even more impressive, being exceeded only by copper, iron ore, and nickel.[46] Within Saskatchewan, it is, as expected, the dominant non-petroleum mineral. In fact, in 1979-81, potash sales even exceeded that of oil and gas.[47]

On the other hand, potash is not a major source of employment: for example, in 1980 during the peak of the industry's prosperity, only 4,160 people were directly employed in the potash mines; this represents less than 1% of total provincial employment.[48] Nevertheless, the available positions are relatively well-paid, lying approximately 20% above the wages rates prevailing in the province's manufacturing sector.[49]

In terms of value-added (VA) activity, it is apparent that potash is somewhat unusual. For instance, VA as a percentage of industry sales is well above that for manufacturing: 86% versus 38%.[50] On the other hand, the proportion of VA appropriated by wage payments is much lower in potash than it is in manufacturing: 10.8% as compared to 45.6%.[51] This fact, coupled with

TABLE 13

Saskatchewan Potash Industry: Historical Data

Calendar Year	Production ('000 tonnes K_2O)	Utilization of Theoretical Capacity (Percent)	Value of Production ($ millions)	Value-Added ($ millions)	Value of Sales ($ million)	Average Selling Price-Current Prices (f.o.b. mine) ($/t$K_2O$)	Real Average Selling Price-1982 Prices (f.o.b. mine) ($/t$K_2O$)	Sask. Production as a % of World Production	No. of Employees
1965	1,470	--	--	--	55.9	41.37	142.56	12.1	--
1966	1,820	--	--	--	62.7	34.72	114.58	13.2	--
1967	2,340	27	70.0	53.7	67.4	31.17	98.90	16.1	1,724
1968	2,700	36	68.8	51.3	65.1	24.60	75.60	17.6	2,086
1969	2,800	37	73.7	49.3	69.4	21.90	64.47	17.6	2,713
1970	3,173	42	111.8	85.7	108.7	35.61	100.50	18.9	2,837
1971	3,572	47	131.8	107.4	145.9	40.48	110.35	20.1	2,519
1972	3,927	52	138.8	111.9	146.0	39.43	102.36	20.4	2,440
1973	4,249	56	161.8	129.2	195.0	40.74	96.92	19.7	2,684
1974	5,496	72	280.6	233.4	311.6	54.38	112.24	23.1	3,224
1975	5,433	72	356.3	297.6	348.5	74.51	138.81	22.1	3,351
1976	4,991	66	323.2	260.3	358.4	69.35	118.03	20.8	3,270
1977	6,090	81	379.7	300.3	398.1	69.85	111.06	24.0	3,628
1978	6,113	81	448.6	357.1	495.7	76.82	114.69	23.3	3,708
1979	6,707	86	732.4	610.5	733.3	102.62	138.95	26.5	3,905
1980	7,302	92	1,046.3	899.0	1,009.8	141.68	172.71	26.5	4,160
1981	7,189	89	--	--	997.5	156.82	173.60	26.0	--
1982	5,213	60	--	--	642.8	126.37	126.37	20.1	--
1983[a]	5,770	66	--	--	683.0	105.00	100.00	--	--

Sources: Derived from David L. Anderson, The Role of Mineral Taxation in Industry/Government Conflict: The Case of the Saskatchewan Potash Reserve Tax (Kingston, Centre for Resource Studies, 1981), p. 90; Energy, Mines and Resources, "Potash", Canadian Minerals Yearbook (Ottawa: Supply and Services Canada, Various Years); Statistics Canada, 1970-1973 (Catalogue 26-220), 1974-1977 (Catalogue 26-222), 1978-1980 (Catalogue 26-224), and Saskatchewan Energy and Mines, Mineral Statistics Yearbook 1982 (Regina: Energy and Mines, 1983), p. 86.

[a] Information displayed for 1983 are estimates based on information supplied by industry and government officals.

the fact that purchases of supplies and materials are first of all a small proportion of sales revenue (14% in 1980) and even more important, generally flow outside the province,[52] leads one to focus on the distribution of capital related receipts and tax payments as the primary mode by which the province benefits from potash development. The first component which is dominated by provision for depreciation and profits largely flows out of the province due to the high level of non-resident ownership: it was 100% prior to the formation of PCS but now resides at approximately 60%. This suggests, that the primary way in which the citizens of Saskatchewan benefit from potash development is through the collection of taxes which are, in turn, recycled through the economy and the profits, if any, of PCS.

The theoretical and institutional discussion of the province's potash-related tax structure constitutes the essence of the following chapter; hence, I shall restrict myself now to merely providing a description of the revenues received from the industry since 1962. From Table 14, note the direct-tax flows appropriated by the province. In the pre-1974 period, tax payments were relatively modest. However, upon the unleashing of the Reserve Tax in 1974, tax payments rose dramatically being roughly 44 times greater in 1976 than five years earlier. Although the tax regime was modified in 1979, the "boom" conditions encountered by the industry during 1979-81 masked the effect of the change. Note that in 1981, revenue collected under the PRPA amounted to $280.3 million; this corresponds to 92% of total Saskatchewan non-petroleum mineral receipts and 14% of the province's total budgetary receipts.[53] In no other provinces, did total non-petroleum mineral revenue exceed 2% of the province's total budgetary receipts in any year between 1970 and 1981.[54] This information can be reformulated to show that during the

TABLE 14

Saskatchewan Mining Taxation and Royalty Revenue: 1970/71 - 1983/84
($millions, in current year dollars)

Year	Oil	Coal	Sodium Sulphate	Potash	Uranium	Other	Total
1971	27.8	-	-	2.47	-	2.30	32.6
1972	28.1	-	-	3.24	-	1.49	32.8
1973	28.9	-	-	6.10	-	1.51	36.5
1974	45.5	0.45	0.23	10.78	-	1.48	58.3
1975	223.1	0.61	0.54	53.34	0.91	1.20	279.7
1976	194.0	0.55	0.75	107.71	1.24	0.58	304.8
1977	203.3	0.59	0.85	82.11	0.43	0.67	288.0
1978	258.2	0.56	1.70	99.77	3.77	0.93	364.9
1979	350.3	0.84	0.87	139.83	5.15	1.85	498.8
1980	396.4	3.80	1.04	161.80	14.88	0.88	578.8
1981	482.7	5.08	1.39	280.26	15.02	2.44	786.9
1982	368.7	7.94	1.55	185.00	29.93	0.88	594.0
1983[a]	497.0	10.17	1.62	60.10	28.00	0.54	597.4
1984[a]	515.1	13.30	2.10	64.10	25.80	0.34	620.7

Sources: Derived from Saskatchewan Department of Finance, Estimates 1983-84, p. 122; Saskatchewan, Saskatchewan Heritage Fund, Annual Report 1981-82, p. 34; and Saskatchewan, Saskatchewan into the Eighties (Regina: Government of Saskatchewan, 1980), p. 61.

(a) Estimated values only; see Saskatchewan, Department of Finance, Estimates 1983-84, p. 122.

1976-1981 period, direct potash taxation receipts captured by the Saskatchewan government amounted to between 34 and 41% of all mineral related tax receipts collected by all governments in Canada.[55]

In summary, the potash industry has been an important source of taxation for the Government of Saskatchewan. However, it may be, as the industry suggests, that it has been overtaxed to the point where it has not expanded as it otherwise would have. This unfortunately leads some policy makers to advocate a rather simplistic and perhaps dangerous solution: if taxes are lowered, they argued that output will increase which will, in turn, eventually lead to higher tax receipts. The validity of this argument is questionable given the cost and demand structure of the sector and the massive under-utilization of prevailing capacity. This subject will also be pursued more rigorously in Chapter 4.

2.6 Future Demand and Supply Projections

From an economist's perspective, the supply and demand projections published by various governmental and international agencies appear to be somewhat unsophisticated. Virtually all such predictions, whether they be those of the World Bank, U.S. Bureau of Mines, Energy, Mines and Resources Canada, or the British Sulphur Institute, appear to have their roots in the annual meetings of the F.A.O. Fertilizer Group.

A system based on "expert" opinion can be expected to yield reasonably accurate estimates of the industry's productive capacity over the short and even medium term. This follows from the 3-5 year gestation period associated with major expansion projects. On the other hand, this approach abstracts from the role of economic variables upon supply elasticities, especially over the medium to longer-term.

However, it is on the demand side that the current approach is rather suspect. This follows from the straight-line projection method implicit in the forecasts: at each point in time, long-term growth estimates are presented for each region or country and used to project demand forward on a year-by-year basis. Hence, the short-term impact of fluctuating prices and incomes is largely ignored. In other words, the technique leads to an estimation of future demand and supply requirements on the assumption that the economic structure remains constant over the length of the evaluation period. It should also be noted that these supply and demand projections are combined to produce supply/demand balances; that is, to show the expected surplus or deficit during each period of analysis. The experts appear to assume that the adjustment will occur on the supply side: given that the demand for potash is perceived to be relatively price inelastic, this is not necessarily a poor strategy, but it does ignore the role of the economic variables discussed above.

The demand/supply estimates presented herein may be labelled as the Barry/Sheldrick model, after the two noted potash experts upon whom they rely for information.[56] From Table 15 it can be seen that Sheldrick[57] expects world potash consumption to grow at an average annual rate of 3.5% over the next decade. However, the rates vary significantly by area, ranging from 2.4% in the developed market economies (DMC) to 5.7% in the developing economies (LDC). It should be noted that these estimates are virtually identical to those of the British Sulphur Institute.[58]

The expected capacity is reported in Table 16. Barry[59] expects total world capacity to increase from 33.3 to 41.9 million t K_2O over the 1982-1992 period. Canadian-based expansions are expected to account for 4.8 million t K2O, or 56% of the total increase.

TABLE 15

Potash Consumption Forecast by Region
(million metric tons K_2O)

	Projections			Average Annual Growth Rate (%)		
	81/82	87/88	92/93	82/88	88/93	82/93
Developed Market Economies	11.6	13.7	15.0	2.8	1.8	2.4
Developing Economies	3.0	4.4	5.5	6.6	4.6	5.7
Centrally Planned Economies	9.2	11.7	14.3	4.1	4.1	4.1
TOTAL WORLD	23.8	29.8	34.8	3.8	3.2	3.5

Source: Derived from William Sheldrick, "The Changing Structure of the International Fertilizer Industry", unpublished paper presented to the Fertilizer Society, London, U.K., 17 March 1983, p. 7.

TABLE 16

World Potash Capacity 1980-1992

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
	(000 tonnes K_2O equivalent)												
North America													
Canada	7 895	8 060	8 680	9 160	9 625	9 910	10 420	11 015	11 345	11 745	12 245	13 000	13 500
United States	2 455	2 530	2 350	2 275	2 305	2 250	2 060	2 020	1 950	1 950	1 950	1 800	1 700
Total	10 350	10 590	11 030	11 435	11 930	12 160	12 480	13 035	13 295	13 695	14 195	14 800	15 200
Western Europe													
France	2 200	2 100	2 000	2 000	2 000	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800
Germany, Fed. Rep.	2 920	2 900	2 900	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700
Italy	200	200	200	200	200	200	200	200	200	200	200	200	200
Spain	780	780	800	800	800	800	800	800	800	800	800	800	800
United Kingdom	360	360	360	360	360	360	360	360	360	360	360	360	360
Total	6 460	6 340	6 260	6 060	6 060	5 860	5 860	5 860	5 860	5 860	5 860	5 860	5 860
Eastern Europe													
Germany, Dem. Rep.	3 400	3 500	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600
U.S.S.R.	10 300	11 000	11 300	11 700	12 400	13 100	13 800	13 800	13 800	13 900	14 200	14 300	14 700
Total	13700	14 500	14 900	15 300	16 100	16 700	17 400	17 400	17 400	17 500	17 800	17 900	18 300
Asia													
Israel	750	750	1 000	1 000	1 000	1 260	1 260	1 260	1 260	1 260	1 260	1 260	1 260
Jordan	-	-	-	200	400	600	720	720	720	720	720	720	720
China, People's Rep.	50	50	50	50	50	50	50	50	50	50	50	50	50
Total	800	800	1 050	1 250	1 450	1 910	2 030	2 030	2 030	2 030	2 030	2 030	2 030
Latin America													
Brazil	-	-	-	-	-	-	100	150	200	250	250	250	250
Chile	30	30	30	30	30	30	30	30	30	30	30	30	30
Mexico	-	-	-	-	-	25	50	50	50	50	50	50	50
Total	30	30	30	30	30	55	180	230	280	330	330	330	330
Other[a]	-	-	-	-	-	-	50	100	100	100	100	100	150
World Total	31 340	32 260	33 270	34 075	35 470	36 685	38 000	38 655	38 965	39 515	40 315	41 020	41 870

Source: George Berry, "Potash", Canadian Minerals Yearbook 1982 (Ottawa: Supply and Services, 1983), p. 31.11.

[a] Includes small production from brines in Australia, Peru or Tunisia.

The above information yields the expected supply/demand balances as reported in Table 17. Note that significant excess supply is expected to prevail throughout the 1980's. By 1990 the surplus will be approaching levels consistent with further expansion; however it is not until 1992 that supply and demand come into balance.[60] Even then, the need for rapid expansion is questionable given the assumption herein that existing plants are only capable of operating at 90% and 85% of rated capacity in North America and the rest of the world, respectively.

The estimation of future potash prices is an extremely tenuous and difficult exercise. Probably the best indicator of long-term real prices is the supply price required to justify new mine construction. According to Sheldrick,[61] such a f.o.b. mine price lies between $140 to $170/t K_2O (1982 prices). This reference point is useful given that virtually all of the long-run studies suggest that the major industry expansion in the future will be located in either Canada or the U.S.S.R. On the other hand, given the excess capacity in the industry and the possiblity of significant expansion using 3rd shafts at existing operations, one might surmise that a price as low as $120 to $140/t$K_2O$ (f.o.b. mine, Sask.) will suffice to bring forth the required supplies over, say, the next decade.

Let us now look at what these estimates imply for Saskatchewan. As can be seen from Table 18, the only Saskatchewan-based expansion that Barry expects to see over the 1983/92 period is the Lanigan project, which is currently under construction. The remaining Canadian expansion, approximately 65% of the total, is anticipated to occur in New Brunswick.

If these projections are correct, there is little likelihood for major expansion of the Saskatchewan potash industry over the next decade. Hence,

TABLE 17

Potash Supply/Demand Balance: 1982-1992
(million tonnes K_2O)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
A) Capacity	33.3	34.1	35.5	36.7	38.0	38.7	39.0	39.5	40.3	41.0	41.9
B) Supply[a]	28.9	29.6	30.7	31.8	32.9	33.5	33.8	34.3	35.0	35.6	36.3
C) Demand[b]	25.4	25.2	26.6	27.9	29.2	30.4	31.5	32.6	33.8	35.0	36.3
D) BALANCE (B-C)	3.5	4.4	4.1	3.9	3.7	3.1	2.3	1.7	1.2	0.6	0.1

Notes: The capacity projections are found in George Barry, "Potash", Canadian Mineral Yearbook 1982 (Ottawa: Supply and Services Canada, 1983), p. 31.11. The demand estimates for 1982-1988 are from William Sheldrick, "Current World Situation and Outlook 1982/83 - 1992/1993", Unpublished Paper presented to the Potash'83 Conference, Saskatoon, October 1983; the projections for 1989-1991 are taken from the British Sulphur Institute, Client Study, 1982; and the 1992 demand estimate arbitrarily assumes an annual growth of potash consumption of 3.5%.

[a] Based on 90% of capacity for North America and 85% of capacity for the rest of the world.

[b] Demand equals expected consumption plus 6% for losses in storage and transport.

TABLE 18

Canada, Potash Mines - Capacity Projections 1980-1990

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	(thousand tonnes K_2O equivalent)										
PCS -											
- Allen (60%)	490	490	490	490	490	490	490	490	490	490	490
- Bredenbury	-	-	-	-	-	-	-	-	-	-	-
- Cory	830	830	830	830	830	830	830	830	830	830	830
- Esterhazy (25% of IMC)	585	585	585	585	585	585	585	585	585	585	585
- Lanigan	545	685	830	830	1 055	1 280	1 510	1 740	1 740	1 740	1 740
- Rocanville	725	750	890	1 090	1 090	1 090	1 090	1 090	1 090	1 090	1 090
Sub-total	3 175	3 340	3 695	3 825	4 050	4 275	4 505	4 735	4 735	4 735	4 735
CCP	815	815	815	815	815	815	815	815	815	815	815
Cominco	545	545	600	655	655	655	655	655	655	655	655
IMC	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 765	1 750	1 750
PPG (Kalium)	845	845	1 055	1 055	1 055	1 055	1 055	1 055	1 055	1 055	1 055
PCA	440	440	440	635	635	635	635	635	635	635	635
Kidd Creek (Allen 40%)	325	325	325	325	325	325	325	325	325	325	325
Sub-total	4 720	4 720	4 985	5 235	5 235	5 235	5 325	5 235	5 235	5 235	5 235
Total Saskatchewan	7 895	8 060	8 680	9 060	9 275	9 510	9 740	9 970	9 970	9 970	9 970
Denison, N.B.	-	-	-	-	-	-	280	500	830	830	830
PCA, N.B.	-	-	-	100	350	400	400	545	545	545	545
Total New Brunswick	-	-	-	100	350	400	680	1 085	1 375	1 375	1 375
Canada (firm)	7 895	8 060	8 680	9 160	9 625	9 910	10 420	11 015	11 345	11 345	11 345
(unspecified)	-	-	-	-	-	-	-	-	-	400	900
TOTAL	7 895	8 060	8 680	9 160	9 625	9 910	10 420	11 015	11 345	11 745	12 245

Source: George Barry, "Potash", Canadian Minerals Yearbook 1982 (Ottawa: Supply and Services, 1983), p. 31.9.

contributions to growth through additional employment or incremental purchases of goods and services are expected to be minuscule. This suggests that rent capturing strategies are of major importance if the province wishes to maximize the contribution which the potash industry may make to the future economic development of the province. The data also suggest that future expansion plans should be closely regulated and evaluated since such actions may only lead to a dissipation of total industry rents.

Before concluding this discussion, I shall explore the possible ramifications of a more optimistic view of the world. Energy, Mines and Resources Canada,[62] in a study undertaken during the "boom" conditions of 1979, estimated that the Canadian-based industry would expand significantly during the 1980's. As shown in Table 19, approximately 7 million t K_2O of additional capacity was expected to be constructed between 1982 and 1990; this is in contrast to the current estimates of 4.8 million tK_2O. Note, however EMR estimates that this activity would only generate an additional 1,700 jobs - probably half of which would be in New Brunswick. Hence, even under an optimistic view of the world, the employment effects for Saskatchewan, both directly and indirectly, are not likely to amount to more than, say, 1% of total current provincial employment levels.[63]

2.7 Future Policy Issues

To this point in the analysis, I have identified or referred to many issues which impinge upon the future impact of the Saskatchewan potash industry on the long-term growth of the province's economy. First, the competitive position of Saskatchewan potash in the near future is not as strong as casual empiricism would suggest. Although long-run production is assured by having access to the lowest cost deposits in the world, Saskatchewan producers still face short and medium term difficulties. These are largely attri-

TABLE 19

Canadian Potash Industry: Estimates of Future Activity, Optimisitic Scenario

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Principal Data - Esimated											
Capacity - thousand tonnes K_2O	8,000	8,280	9,050	9,580	10,880	12,070	12,850	13,570	14,698	15,410	16,000
Production - thousand tonnes K_2O	7,200	7,452	8,145	8,622	9,792	10,863	11,565	12,213	13,221	13,869	14,400
Value of production C$ millions	828	857	1,018	1,173	1,420	1,695	1,943	2,198	2,552	2,871	3,211
Employment - mines	4,000	4,020	4,260	4,380	4,830	5,200	5,380	5,520	5,800	5,900	5,952
- construction	1,300					Av. 1,600/yr					
Capital investment C$ millions	160	300	320	330				2,100 total			

Source: Energy, Mines and Resources Canada, Potash: A Proposed Strategy (Ottawa: Supply and Services Canada, 1982), p. 3.

Notes:

(i) Capacity: Canadian Canadian share of world capacity will increase from 24% to 32% in 1979 to 32% in 1989. (The U.S.S.R. being the chief competitor).

(ii) Production: World consumption will rise by 4.3%/yr. and with tight supply Canadian mines could operate at 90% capacity.

(iii) Prices: After stability at a high level of $115/t.$K_2O$ in 1980-81 prices could rise up to 2% above inflation levels; the informetrics implicit deflator was used to indicate this relationship and calculate unit values which were used to calculate value of production.

(iv) Employment: Production per mine employee in 1980 is estimated at 1,800 t/man/yr. It is assumed that productivity will rise by 3%/y in the 1980's.

butable to the role of transportation: the province's product must move over a greater distance to reach the port of export than that encountered by its competitors. Furthermore, even the province's traditional locational advantage in the U.S. corn belt is, at least temporarily, being threatened by Israeli and perhaps New Brunswick producers, due to a relative shift in sea/rail freight rates.[64]

Second, the current world-wide economic slump has had a significant impact on the potash trade. In the U.S., a major decline in both seeded acreage and crop prices has led farmers to reduce potash applications; this, however, can only be prolonged for two or three years without generating a long-term deleterious effect on the soil's productive capacity. Offshore, the long awaited boom has yet to take place. This is primarily attributable to a severe ability-to-pay problem; however, this market has also been affected by limited diffusion of knowledge with respect to the agronomical impact of potash.

A third issue arises from the desire of the Saskatchewan government to encourage industry expansion within the province. Unfortunately, such a course of action is extremely suspect given short to medium demand estimates, prevailing utilization rates, and the industry's cost and demand structures. Once again, this argument will be taken up in Chapter 4.

All of these issues suggest that the Government of Saskatchewan has a role to play in determining the optimal size of the province's potash industry. It also suggests the need for better market intelligence. Before directly addressing the critical issues of marketing arrangement and optimal productive capacity, I shall assess and describe the taxation of the potash industry. This is important not only for purposes of discussing the contribution which economic rent may make to the potential growth of the province's

economy but also for exploration of the interrelationship between taxation, efficiency, and industry expansion.

FOOTNOTES

1. Reserves are defined as ores that can be recovered at or near current market prices. Resources are defined as potentially mineable ores with existing technologies which, due to cost or other constraints, may not be recoverable at present market prices.
Although these are widely accepted definitions, published reserve estimates vary significantly. Those shown are based on James P. Searls, "Potash", in Minerals Commodity Profiles 1983 (Washington: U.S. Bureau of Mines, 1983), p. 2. However, other potash experts suggest that Saskatchewan's position, especially with respect to resources is less dominant. For example, Sheldrick and Stier estimate the province's share of world reserves and resources to be 70 and 48%, respectively (see William F. Sheldrick and Harald Stier, World Potash Survey, World Bank Staff Working Paper No. 293, Washington, September 1978, p. 4).

2. For a discussion of the factors influencing the demand for potash, see John Richards, Primary Industry and Regional Development: Potash in Saskatchewan, unpublished Ph.D. Thesis, Washington University, St. Louis, August 1982, pp. 188-190.

3. The basic concepts of demand theory presented throughout this section come from the common domain of intermediate micro economics. For example, see Edwin Mansfield, Micro-Economics: Theory and Applications, 4th edition (New York: Norton, 1982); C.E. Ferguson, Microeconomic Theory, 3rd edition (Homewood, Illinois: Richard D. Irwin, 1972); and James M. Henderson and Richard E. Quandt, Microeconomic Theory: A Mathematical Approach, 3rd edition (New York: McGraw-Hill, 1980). Potash specific discussions can be found in W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, Energy, Mines and Resources MR 139 (Ottawa: Information Canada, 1973); John G. Richards, Primary Industry and Regional Development: Potash in Saskatchewan; and June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan, Unpublished Ph.D. Thesis, University of Toronto, 1982.

4. It must be stressed that the term grain is used here as a euphemism for potash-intensive crops. Although grains fall within this category, so do other crops.

5. This argument is also based on the principle of diminishing marginal utility.

6. For supporting evidence, see John G. Richards, Primary Industry and Regional Development: Potash in Saskatchewan, pp. 249-256b. It should be noted that off-shore grain prices have, at least since 1955, increased somewhat in real terms. Domestic prices, although subject to significant year to year variation, have shown little long-term variation.

7. For example, see C.E. Ferguson, Microeconomic Theory, Chpts. 13,14. The equation presented applies only to firms viewing their imput and output prices as being exogenously determined. The more general relationship is $MR_g \cdot MPP_K = MEI_K$ where MR_g and MEI_K represent the marginal revenue of grain and the marginal expense of potash, respectively.

8. See John G. Richards, Primary Industry and Regional Development: Potash in Saskatchewan, pp. 187-190; 235-240.

9. This will occur to some extent unless the associated production function is linearly homogeneous; for details, see any standard microeconomic text such as C.E. Ferguson, Microeconomic Theory, pp. 194-197; 414-420.

10. If the production function is of the fixed proportions variety over the relevant operating range, a given percentage increase in grain output will require the same percentage increase in potash usage. Hence, for any change in P_g, it follows that $E1(D_g; P_g) = E1(D_K; P_g)$.

11. This effect may, of course, be negated by technological change in the production of foodstuffs. However, the basic premise discussed herein seems to be plausible given that arable land is declining in quantity and quality in many parts of the world, and world population continues to increase by more than two percent per annum.

12. For a discussion of the adjustment process, see C.E. Ferguson, Microeconomic Theory, pp. 399-403.

13. Edwin Mansfield, Micro-Economics: Theory and Applications, p. 369.

14. For example, see B.M. Litvack, The Canadian Potash Industry, Report 62, Canadian Transport Commission, September 1973, p. 23; Joseph Kruger and Neil Thurston, A Study of Factors Affecting the Marketing and Transportation of Potash, Report #30-78-04, Canadian Transport Commission, Ottawa, July 1978, p. 51; Patrick James Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, Ph.D. Thesis, University of Toronto, 1980, p. 389-390; John G. Richards, Primary Industry and Regional Development: Potash in Saskatchewan, p. 189; Douglas A. Karvonen, "The Saskatchewan Potash Prorationing and Price Stabilization Program", CIM Bulletin, April 1973, p. 2; William F. Sheldrick and Harald Stier, World Potash Survey, p. 55; and W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, p. 22.

15. W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, p. 91. This quote is based on the work of S.P. Hayes, "Potash Prices and Competition", Quarterly Journal of Economics, Vol. LVII, November 1942, pp. 32-43.

16. Based on the Potash Corporation of Saskatchewan's price lists as at 10 October 1979 and 10 November 1983, the transportation and handling proportion of the final price at Springfield, Illinois was 40% and 38%, respectively.

17. For instance, according to Joseph Kruger and Neil Thurston, A Study of Factors Affecting the Marketing and Transportation of Potash, p. 58, transportation and handling charges accounted for 53% of the landed price, of Saskatchewan potash in India in 1976.

18. Assume that $P_{K,M}$ increases by 1.0%. Given that transportation charges are assumed to be equivalent to $0.33 \cdot P_{K,M}$, then $P_{K,FG}$ increases by 0.75%. Furthermore, since I have assumed that $P_N = P_P = P_K$ and that N, P and K are used in fixed and equal proportions, the farm-gate price of fertilizer ($P_{F,FG}$) increases by only 0.25%.

19. Edwin Mansfield, Micro-Economics: Theory and Applications, p. 369.

20. See Chapter 1 for a discussion of the role of potash as a plant nutrient.

21. This follows from the equilibrium condition: $P_g \ MPP_K = P_K$. If P_g increases, everything else being equal, the use of potash must increase in order to drive down MPP_K to a level which restores equilibrium.

22. W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, Energy, Mines and Resources Study MR 139 (Ottawa: Information Canada, 1973).

23. It should be noted that Ibid. does not present estimates for the U.S.S.R. This is undoubtedly due to a lack of reliable information on that nation's potash mines. Discussions with government and industry sources suggest that operating costs (1983 price levels) for Saskatchewan-based producers, is currently in the \$40 to \$50/tK_2O range. These estimates are quite consistent, after adjustment for inflation, with those provided by David L. Anderson, The Role of Mineral Taxation in Industry/Government Conflict: The Case of the Saskatchewan Potash Reserve Tax (Kingston: Centre for Resource Studies, 1981), pp. 99-102; John G. Richards, Primary Industry and Regional Development: Potash in Saskatchewan, p. 195; June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan, p. 356; and William F. Sheldrick, "Investment and Production Costs for Fertilizers", a paper presented to the F.A.O. Commission on Fertilizers, Eighth Session, Rome, January 1983.

24. Energy, Mines and Resources Canada, Potash: A Proposed Strategy, Study MR 194 (Ottawa: Supply and Services Canada, 1982), p. 2.

25. For a discussion of transportation problems encountered by Saskatchewan-based potash producers, see B.M. Litvack, The Canadian Potash Industry, Canadian Transport Commission, Report 62, September 1973; and Joseph Kruger and Neil Thurston, A Study of Factors Affecting the Marketing and Transportation of Potash, Canadian Transport Commission, Report #30-78-04, Ottawa, July 1978.

26. As reported in British Sulphur Institute, Client Study (unpublished), 1982.

27. As reported in Ibid.

28. See Energy, Mines and Resources Canada, Potash: A Proposed Strategy, p. 9.

29. Based on discussions with Canpotex officials, September 1983.

30. See W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, pp. 19,20,22.

31. Joseph Kruger and Neil Thurston, A Study of Factors Affecting the Marketing and Transportation of Potash, p. 51.

32. W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, p. 20.

33. The following discussion draws heavily on F.M. Scherer, Industrial Market Structure and Economic Performance (Chicago: Rand McNally, 1980), 2nd Edition, pp. 205-212.

34. It should be noted that although bankruptcy results in a loss to the equity holder, it does not represent a cost to society. In other words, bankruptcy results in a redistribution of wealth but not a reduction in society's overall wealth position.

35. For a detailed discussion of this phenomenon, see F.M. Scherer, Industrial Market Structure and Economic Performance, pp. 205-212.

36. For example, see William F. Sheldrick, "Current World Situation and Outlook 1982/83 - 1992/93", a paper presented to Potash '83 Conference, Saskatoon, October 1983, p. 7.

37. It must be stressed that these prices are f.o.b. mine, Saskatchewan.

38. This estimate is based on discussions with industry and government officials and on William F. Sheldrick, "Investment and Production Costs for Fertilizers", p. 62. More specifically, Sheldrick estimates that new mine costs in Saskatchewan are such that expected f.o.b. mine price (1982 price level) must be in the order of \$140-\$170/tK_2O. However, given that major incremental expansions are available for only 60% of the per tonne cost of a new venture it can be shown that such expansions are viable if expected selling prices range from \$120 to \$140/tK_2O. This estimate is based on the assumption that depreciation and capital charges are only 60% of the corresponding new mine value. On the other hand, operating costs are assumed to be equivalent for both types of operations.

39. Ibid.

40. Rents will probably still be earned on prior installations. These, however, could also be dissipated if destructive competition occurs to the

point where prices decline too such an extent that only normal profits on previously constructed mines and expansions are being appropriated.

41. This is admittedly difficult to do without forgoing rents due to the inherent uncertainty involved in estimating future demand and the lag between the decision to add capacity and the availability of the associated production. However, it should be noted that the mere announcement of major expansion plans by a low cost producer may have the effect of forestalling planned expansion by marginal producers.

42. Based on discussions with industry and government officials.

43. See Philip L. Reeves and Maurice Hall, "Potash-Seen on the Road to Recovery", The Northern Miner, Vol. 69, No. 38, 24 November 1983, p. (B18).

44. Based on Ibid; "Potash Sales Strong", Leader-Post, Regina, 30 November 1983, p. (E.6); and discussions with industry and government officials.

45. D.M. Buch, "Regional Review 1981", Canadian Minerals Yearbook 1981 (Ottawa: Supply and Services Canada, 1982), p. 48.6.

46. Energy, Mines and Resources Canada, "Statistical Summary of the Mineral Industry in Canada", Canadian Minerals Yearbook 1981 (Ottawa: Supply and Services Canada, 1982), Chapter 50, Table 19.

47. Saskatchewan Bureau of Statistics, Economic Review 1982, Regina, 1982, p. 17.

48. Saskatchewan Bureau of Statistics, Economic Review 1982, p. 13.

49. Ibid.; and Statistics Canada, Non-Metal Mines 1980, Cat. 26-224 (Ottawa: Supply and Services Canada, 1983).

50. Saskatchewan Bureau of Statistics, Economic Review 1982, p. 19; and Statistics Canada, Non-Metal Mines 1980.

51. Ibid.

52. Although potash-specific estimates were not found, a plethora of information exists on the Saskatchewan uranium industry which supports this statement. For example, see G.J. Holman, Impacts of Canada's Uranium Mining Industry, Study No. 14 (Calgary: Canadian Energy Research Institute, 1982).

53. Derived from Table 14 and Saskatchewan Department of Finance, Estimates 1982, Regina, 1982.

54. See David L. Anderson, "Mining Taxation and Royalties in Saskatchewan", a paper presented to the Mining Law Institute, University of Saskatchewan, 24 June 1983, p. 4.

55. Derived from Ibid., p. 5 and Table 14.

56. George Barry, Energy, Mines and Resources Canada and William Sheldrick, World Bank.

57. Data obtained from William F. Sheldrick, "The Changing Structure of the International Fertilizer Industry", unpublished paper presented to the Fertilizer Society, London, U.K., 17 March 1983.

58. British Sulphur Institute, Client Study, unpublished, 1983.

59. George Barry, "Potash", Canadian Minerals Yearbook 1982.

60. Note that most of the adjustment is assumed to take place on the demand side. That is, installed capacity at the beginning of the period remains potentially operative throughout the life of the analysis. However, as recent events have shown, marginal mines, especially those associated with a largely exhausted ore body, may close down earlier than otherwise due to market conditions. Nevertheless, the basic premise that most of the market adjustment will occur on the demand side is probably a reasonable premise.

61. See Footnote #38.

62. Energy, Mines and Resources, Potash: A Proposed Strategy, p. 3.

63. Assuming 900 new jobs in Saskatchewan mines and a rather unrealistic multiplier of 4, results in 4,500 jobs, which is approximately 1% of the 1981 employment level of 432,000 (source: Saskatchewan Bureau of Statistics, Economic Review 1982, p. 13).

64. During the current recession, sea-freight rates have fallen substantially whereas freight rates (rail) have remained relatively stable. This has aided those operators located close to ports such as those in Israel.

CHAPTER THREE TAXATION AND ECONOMIC RENTS

3.1 The Concept of Economic Rent

Although a rigorous discussion of the theory of economic rent is beyond the scope of this study, a brief presentation is in order given the relevance of the concept to public policy formulation. Following Bucovetsky and Gillis, economic rent is herein defined as "a gift of nature whose exploitation yields a return beyond the necessary factor payments to the labour and capital required for its discovery and extraction."[1] In other words, it represents the surplus from the proceeds of sale after all necessary inputs into the production process have been sufficiently compensated to ensure their continued employment in the industry. It is important to note that among the factors subject to reimbursement are capital and entrepreneurship.[2]

The advocates of rent extraction base their claim on three primary arguments. First, it is alleged that since rent is attributable solely to ore body characteristics, it belongs to the owner of the resource. Hence, if the crown holds legal title to the sub-surface rights, the rent should be appropriated by the state. Second, it is further argued that even if legal title has been alienated from the crown, the unearned nature of the surplus provides a sufficient justification for state confiscation of all or part of the resulting surplus. This follows from the fact that the developer has already received compensation equal to the opportunity cost of capital and entrepreneurship. The third rationale rests on the premise that since economic rent represents what is left over after all factors of production have received compensation at least equal to their opportunity cost of employment, it follows that the residual may be appropriated without any impact on investment or operating behaviour.

Indeed, an economic rent tax is the only levy of any practical import possessing the property of economic neutrality; all others affect investment and/or operating decisions in one manner or another, resulting in a reduction in society's welfare.[3] The problems encountered in putting theory into practice will be explored below.

3.2 Distribution of Value Added

A further rationale for focussing on rents stems from the nature of the distribution of the value added generated by the potash industry. As previously stated, wages constitute only 10 to 15% of the available surplus and, given the ownership structure of the industry, approximately 60% of the remainder, excluding taxes to the provincial government, flow out of the Province. Furthermore, even the indirect income generated within Saskatchewan by the purchase of goods and services during both the construction and operating stage, is rather meagre.[4] This follows from the virtual absence of backward linkages between the potash industry and other elements of the Saskatchewan economy. Equally dismal are the prospects for forward linkages. Potash is essentially processed to the maximum feasible extent at the mine; it is then shipped directly to bulk fertilizer plants for mixing with nitrogen and phosphorus. This mixing process is location specific due to the high weight to value ratio displayed by the product and the need to tailor fertilizer applications to local soil conditions.

This discussion, although provided without quantitative support, suggests that the potash industry's contribution to economic growth comes from principally two sources: direct employment effects at both the construction and operating stage and, probably more importantly, from the acquisition of tax revenue. The latter, if it can be targeted towards the capture of economic rent has the advantage of being allocatively neutral: it does not

affect investment and operating decisions.[5] Let us now proceed to describe the various taxation measures which have been employed in the Saskatchewan potash sector since 1950.

3.3 The History of Potash Taxation

In this section I shall briefly review the history of potash taxation in Saskatchewan and then focus on the present day scheme: the Potash Resource Payments Agreement (PRPA). After the discovery of potash in commercial quantities in the 1940's, the Douglas government tried to develop the deposits through joint ventures. Once it became apparent that this approach would not succeed, the CCF government turned towards the private sector for developmental initiatives.[6]

The legal framework within which such activity was to take place was contained in the Potash Regulations of 1950.[7] The crown royalty was set at the lesser of 5% of sales value or 25% of net income. In 1953 the Potash Regulations were replaced by the Subsurface Mining Regulations;[8] at this time the tax levy was altered to 4.5% of the deemed value of the ore mined. However, if the ore was found to contain more or less than the expected 21% K_2O/st of ore, then the effective tax rate differed from the statutory rate by the proportion by which the actual ore grade exceeded or fell short of the 21% bench mark. This scheme represented a crude attempt to capture a uniform proportion of each operator's profits at any point in time.

In 1956 the present day crown royalty system was adopted:[9] a levy which appropriates approximately 2.5% of sales revenue. The scheme provides for a tax rate which is functionally related to the ore grade, ranging from 4.25% to 9.0% at ore grades of 20% and 45%, respectively. However, the effective rate is substantially less since only 49% of actual revenue is

recognized for tax determination purposes. More formally, the crown royalty may be specified as TP = R * 0.49 * SV where TP, R, and SV represent tax paid, tax rate, and sales value, respectively. This version of the crown royalty was guaranteed by the CCF government, in January 1964, to apply for the following 10 years and was subsequently extended to 1981 by the Thatcher government.[10]

Freehold production was first subjected to taxation in 1965 at a rate of 8 mills per dollar of assessed property value (AV).[11] Interestingly, AV was set at twice the value of the prior year's sales revenue; hence, we see another example of a purported property tax being, in reality, a disguised ad valorem production tax. Later, in the same year, the scheme was adjusted to reflect, in a rather unsophisticated manner, the impact of ore grade differentials on expected operating profits.[12] This system, which is still technically in force, may be portrayed as TP = 0.008 * 2 * SV(t-1) * ($\%K_2O/30$) where SV, as before, represents sales value.[13]

Shortly after the NDP assumed power in June 1971, the then Minister of Mineral Resources expressed his displeasure with the size of the industry's contribution to the consolidated revenue fund.[14] In a stop-gap measure to redress this situation, the government instituted the Prorationing Fee which was levied at a rate of 60 cents per product ton; this impost was doubled in 1973 and 1978 it was declared to be ultra vires provincial powers.[15]

The most important and controversial tax ever levied on the industry was undoubtedly the Potash Reserve Tax (RT) as enacted in November 1974.[16] This impost, which was as much a non-tax instrument as a revenue generator, will now be briefly described.[17] Although the scheme was portrayed as a property tax, it is more accurately described as a disguised profits tax. By sub-

jecting the statutory version of the tax to elementary algebraic manipulations, we obtain:

$$RTP = PARR(ASP).\left\{EO \cdot [ASP - UC(e)]\right\}.\left\{\frac{OGF}{CIF}\right\}$$

where

RTP = Reserve Tax payment;
ASP = average annual selling price per short ton of potassium oxide ($/st$K_2O$);
PARR(ASP) = planned average reserve tax rate as a function of ASP;
EO = estimated annual output
UC(e) = expected unit operating cost of production of a mine with a given rated annual capacity of e;
CIF = capital investment factor.
OGF = ore grade factor

From this specification, it can readily be seen that the Reserve Tax is, in fact, a predictive profits tax. The variable PARR represents the rate at which expected profits are taxed; it can also be shown to be steeply progressive with respect to the selling price (ASP). The second term is the expected profit calculation for a representative mine of size "e". This follows from the fact that output (EO) is multiplied by the expected level of profit per unit of output for a mine with a rated output capacity of "e". The third term represents two firm-specific adjustments which provide for the recognition of inter-firm variations in ore-grade and capital costs per st of capacity, respectively.

Under the Reserve Tax, a representative firm's marginal tax rate could easily exceed 90% of incremental sales revenue.[18] In fact, between July 1974 and June 1975, when the Reserve Tax was non-deductible against both the federal and provincial corporate income tax, marginal rates could easily exceed 100%. The corresponding average rates were generally found to be in the order of 75 to 90% of pre-tax book profits. Perhaps the best method of

assessing the impact of the RT on the industry's financial state, is to look at the expected change in rates-of-return on investment. From Table 20, note that a representative mine obtaining, say, \$60/stK_2O for its product, could be expected to earn a pre-tax accounting rate of return of 31% on its net investment. Prior to the introduction of the RT, the corresponding after-tax rate was approximately 15%, but afterwards, it dropped to 6.3%.

Needless to say, the resulting industry response was acrimonious and the subsequent confrontation, both in and out of court, led to the partial nationalization of the industry during the 1976 to 1978 period. As a result of this process, the Potash Corporation of Saskatchewan acquired approximately 40% of the industry's productive assets.[19,20]

The signing of the Potash Resource Payments Agreement (PRPA) in late 1979, retroactive to 1 July 1979, essentially brought to an end the above described tax and ownership struggle.[21] As a result of the PRPA, the Potash Reserve Tax, the Producing Tract Tax, and the Crown Royalty were, in practice, replaced by a quasi-rate-of-return levy.[22]

The PRPA was implemented through individual contracts between the province and each producer, and covered the period 1 July 1979 to 30 June 1984. This approach was adopted for legal reasons since the province, at that time, was experiencing difficulty in taxing freehold production. Since the latter accounted for approximately 45% of total industry production, an effective levy had to recognize this fact and the then existing direct/indirect taxation dichotomy.[23]

The new scheme was a hybrid unit production and rate-of-return tax. More specifically, the first 300,000 st K_2O of annual production was to be taxed at \$6/st with excess output charged \$7.50/st. This levy, denoted as

TABLE 20

Representative Saskatchewan Potash Mines:
Maximum Marginal Tax Rates for Various Combinations of Selling Price and Tax Scheme, End-1974 Prices
(Percent)

Tax Scheme	Average Selling Price ($/st K_2O)					
	40	50	60	70	80	90
Pre-reserve tax Federal and provincial deductibility	51.0	51.0	51.0	51.0	51.0	51.0
Reserve tax Federal and provincial deductibility	70.5	77.6	80.6	81.4	82.0	82.7
Federal and provincial nondeductibility	68.5	92.3	98.3	99.7	101.0	102.3
Federal nondeductibility, provincial deductibility	64.7	85.7	90.9	92.2	93.4	94.5

Source: David L. Anderson, The Role of Mineral Taxation in Industry/Government Conflict: The Case of the Saskatchewan Potash Reserve Tax (Kingston: Centre for Resource Studies, 1981), p. 39.

the Base Payment (BP), stands alone: it is not deductible against the Graduated Payment (GP).

The latter charge is functionally related to an operator's rate-of-return on capital investment (ROI). More specifically, ROI is the ratio of operating profit (OP) to the Capital Investment Account (CIA). Once found, GP is readily calculated by referring to the following table.

If ROI ratio is	then the graduated payment (GP) is:
- less than 5%	(a) 10% of operating profit in this range
- 5% and greater but less than 15%	(b) 20% of operating profit in this range plus amount payable in (a)
- 15% and greater but less than 25%	(c) 30% of operating profit in this range plus amount payable in (b)
- 25% and greater but less than 35%	(d) 40% of operating profit in this range plus amount payable in (c)
- 35% and greater	(e) 50% of operating profit in this range plus amount payable in (d)

The numerator of the ROI calculation warrants elaboration. Operating profit (OP) is equal to gross revenue (GR) less operating costs (OC). The latter is determined in a rather complicated fashion: it is the sum of: direct production costs, arbitrary allowances for administration, marketing, and transportation and storage; non-potash specific taxes excluding federal and provincial corporation income tax; depreciation; and a standard deduction which is the lesser of operating profits defined without reference to this clause and 5% of the Capital Investment Account (CIA).

The use of arbitrary allowances is based on the planner's attempt to reduce the likelihood of transfer pricing activity. For example, administrative overhead and marketing expenses are deemed to be 2% and 3% of gross revenue, respectively. Similarly, potash sold from company owned warehouses ex mine is assumed to cost the firm an incremental $8/st KCL. In addition, potash sold in the above fashion is granted a further $3/st KCL transportation charge in lieu of loading costs.

Since the PRPA does not provide for full capital cost recovery before the imposition of GP, an allowance for depreciation (AFD) is provided. The AFD is determined in the following manner. For capital expenditures incurred prior to 1 July 1979, the sum of which is denoted as the Opening Investment Account (OIA), an expense allowance equal to 4.5% of OIA is permitted. On the other hand, permissible outlays incurred since the inception of the agreement are subject to a 10% annual allowance. It should be noted that these investment accounts are not reduced in value as a result of the expense claim. Although this is a questionable procedure, it may represent a crude attempt to offset the effects of inflation on the replacement value of the capital assets.

Two comments are in order with respect to the treatment of depreciation under the PRPA. First, casual empiricism suggests that the use of a two tier structure is an attempt to encourage incremental expansion without significantly eroding the tax base. Second, note that for purposes of calculating the Opening Investment Account (OIA), one either employs the value of historic expenditures incurred prior to the commencement of commercial production or, if the mine were purchased as an on-going entity prior to 1 July 1979, the resulting purchase price. This design feature aided PCS since the crown corporations capital assets are valued in 1976 to 1978 prices whereas the OIA's attributable to private producers are largely denominated in 1960 to 1970 prices.

The so-called standard deduction is an annual automatic allowance calculated as 5% of each firm's allowable capital investment base. This means that GP does not really apply until a 5% ROI has been achieved by the operator. Hence, the rate schedule previously presented is somewhat misleading:

the denoted marginal rates apply to brackets that are uniformly 5% higher than the statutory specification. The reason for employing this rather convoluted process is not clear although it may represent a "face-saving" strategy by the former government. As a result of the "5% deduction", the rate structure appears to be more severe than it really is and thus the degree of conciliation displayed by the Blakeney government is understated. Since the PRPA was developed during a period in which tne potash policy was the "flagship" of NDP resource policy, it may have been deemed important to minimize alterations which could be interpreted as a weakness on the part of the government.

To this point, I have ignored one important component of the tax calculation: the Capital Investment Allowance (CIA), the denominator of the ROI calculation. It consists of the sum of two elements: the Historic Investment Account (HIA) and the Expansion Investment Account (EIA). The former represents the historic value of capital expended prior to 1 July 1979. The second element represents those outlays, once again denominated in historical prices, incurred subsequent to 1 July 1979 for which rated productive capacity increased by at least 15%.

It is apparent that the impact of inflationary pressures will be to increase the reported rate-of-return over time. Hence, firms are artificially shifted into higher tax brackets. Indeed, they may eventually find themselves in the 50% PRPA bracket, and yet not be earning any economic rent as it is traditionally defined.[24]

The PRPA is obviously a creature of its troubled past. It represents an ad hoc series of adjustments to facilitate expansion of the industry while at the same time allowing the government to capture significant revenues. It also allowed the Blakeney government to preserve its reputation for firmness

with respect to non-renewable resource activities. Although flawed from an economic efficiency perspective, the levy has nonetheless been a short-term pragmatic success. It has led to improved business/government relations and planned expansion of the industry. In addition, the unique characteristics of the Saskatchewan potash industry suggests that the neutrality violations denoted above are not likely to be of practical significance over the short-term.[25]

Although a detailed assessment is beyond the scope of this paper, a few comments are in order. According to Caragata,[26] industry sources have suggested that given the price and cost factors prevailing in 1979, the PRPA leads to the capture of approximately 75% of the revenue forthcoming under the Reserve Tax (RT). Upon a rather cursory examination of the data, Caragata speculates that the correct figure may be closer to 60%. From a producer's perspective, the tax load is still rather high; they claim to face, at certain times, marginal and average tax rates of approximately 85% and 70%, respectively.[27,28]

The overall impact of the PRPA on the industry's economic performance is difficult to assess for the reasons noted above - an absence of published information on the topic. Nevertheless, based on casual empiricism, the PRPA has shown itself to be: consistent with on-going operation; the proper maintenance of capital; and even the initiation of so-called "cheap" incremental expansions.[29] On the other hand, major expansions and, most certainly, new mine developments, are not considered to be viable propositions.[30]

From the perspective of the Blakeney government, the PRPA was undoubtedly a success. It allowed the government to capture a significant amount of tax revenue[31] while, at the same time, facilitating a modest degree of expansion. Although expansion, per se, is questionable from an economic perspec-

tive, given my previous discussion of the industry's supply and demand characteristics, it is a politically popular outcome. In essence, the PRPA represented a politically successful balance between the NDP's rent capturing and economic growth objectives.

Although the Blakeney government appeared to view expansion of the potash industry as inherently "good", it did institute an effective control mechanism over industry expansion plans. Interestingly, the primary vehicle chosen for this task was the PRPA. This was achieved through the provincial government's power to decide whether or not to recognize investment outlays for purposes of calculating the PRPA. More specifically, the Minister of Energy and Mines possesses the right to allow or disallow the investor to include a project's capital expenditures in the mine's Capital Investment Allowance (CIA) - the denominator of the rate of return calculation.[32]

Despite the absence of supporting evidence, it should be apparent that a negative decision, in this regard, will make it very difficult for any project to pass the requisite investment decision-rule. In practice, only one such request was refused; the response of the proponent, Noranda Mines, was to cancel the planned expansion of its Colonsay mine.[33]

Although the Devine government obviously places more emphasis on growth objectives than did the Blakeney regime, it would be wise for it to retain this type of discretionary power over future expansion plans. This is not to say that the PRPA must be maintained as is; indeed, it could be entirely scrapped. Instead, it is proposed that due to the previously described possibility that too much expansion may lead to destructive competition and hence a dissipation of rents, any provincial government in Saskatchewan should maintain effective control over the size of the potash industry. One

of the more effective ways of doing so is through the non-renewable resource tax system which clearly lies within provincial powers.

Changes to the PRPA are imminent since the tax, as it is presently specified, lapses on 30 June 1984; indeed, negotiations on a new structure are currently underway. In this regard, the newly formed Saskatchewan Potash Producers Association (SPPA) submitted a brief to the province in March 1983, in which they advocate[d] that the PRPA be scrapped and replaced by a British Columbia style mining income tax.[35]

In addition to an income tax levy (IT) based on a proportional rate structure, the SPPA's proposal reportedly calls for a base unit levy which is, in essence, a revenue guarantee for the government during lean times. That is, a levy of $/st$K_2O$ will be assessed (BT); if IT > BT, then IT is paid to the government. However, if BT > IT, then BT is paid in the applicable time period, but the difference between BT and IT, denoted as DF, is carried forward as a deduction to be applied against tax payments in subsequent years. In essence, any DF is an interest free loan from the operator to the province. Furthermore, the proposal calls for the mining income tax rate structure to be gradually reduced over the 1984 to 1987 period so that by 1987, the combined federal/provincial corporate and resource tax levies capture, at a maximum, 55% of pre-tax book profits.[36]

An additional objective of the SPPA appears to be to convince the government of the necessity of removing the discretionary controls over expansion decisions which exist within certain provisions of the PRPA.[39] Acceptance of this request would be tantamount to saying that all expansions are beneficial to the province. This is, as I have previously suggested, difficult to accept in the context of the Saskatchewan potash industry.

From the provincial government's perspective, the scheme would provide a badly needed counter-cyclical cash-flow.[37] That is, revenues in difficult times can be expected to equal or exceed that forthcoming from the PRPA but to be significantly less during "boom" conditions. Hence, the government's deficit is assisted while the firms obtain a reduction in the net present value of the tax stream associated with a given potash development.

The changes proposed by the SPPA are not necessarily in the Province's long-run interests. First, the proposed levy is also non-neutral and this leads to investment and operating disincentive effects.[38] Furthermore, the proposed scheme is inherently unstable: when profits are high, political pressure mounts if it appears that the mining sector is not paying its "fair share" of rents to the state. Arguments related to past contributions carry little weight with the electorate and hence the private operators find themselves under intense pressure to increase their tax payments. Thus the political risk associated with new investments will increase over that associated with the PRPA.

This last problem is further exacerbated by the fact that if the NDP returns to power, they will almost invariably alter any agreement which they perceive to have been largely a transfer of rents from the public to the private sector. This further increases political risk, especially with respect to long-term, high cost ventures such as new mines.

The logic behind both the SPPA's proposal for altering the PRPA is as follows: firms are not able to retain enough of their cash-flow to finance expansions; if taxes are lowered, cash-flow will increase and the probability of expansions taking place will also increase;[40] this, in turn, should ultimately lead to an increase in taxation receipts. However, as will be demon-

strated in the next chapter, such logic is rather suspect given the industry's cost and demand structure.

From the Saskatchewan government's perspective, there are problems with this policy. For instance, what happens if expansion fails to occur? The government will then be placed in a difficult political situation since their actions may be perceived as merely transferring rents from the public to the private sector. This is further exacerbated by the fact that most of the beneficiaries are non-resident shareholders; this suggests that the resulting spin-off benefits to Saskatchewan may be exceedingly low. A possible solution to the dilemma is to obtain, with respect to future expansions, informal promises or to change the tax structure so as to treat that expansion capital in a much more generous fashion than that afforded past investment.[41] Although this is bound to be unpopular with some miners, it represents a compromise between a desire for expansion on the part of the politicians and the need for a better tax deal as perceived by the operators.

Although the PRPA violates a number of tax principles, especially that of tax neutrality,[42] the proposed scheme does not rectify the basic problems in any material manner. It does, however, reduce the severity of the impact of inflation by relying upon a proportional as opposed to a progressive rate structure and that of perverse incentives generated by marginal tax rates approaching 85% to 90%.[43] On the other hand, it is still blatantly non-neutral. Indeed, it is difficult to surmise that the changes will have any other impact but to transfer economic rents from the public to the private sector. This follows, in part, from the questionable benefits associated with incremental expansion given the financial environment currently facing Saskatchewan producers.

3.4 The Role of the Potash Corporation of Saskatchewan

The reader will recall the previous discussion of the Potash Reserve Tax (RT). As a result of the impact of the new levy on the industry's financial position, the mine owners reacted in an acrimonious manner: they withheld financial information required by law; refused, at times, to pay tax liability as they fell due; initiated an aggressive anti-government media campaign, and resorted to a series of legal challenges to virtually all of the province's potash related control devices.

The Blakeney government responded to what it viewed as an attempt by the potash industry to set itself above the law. Due to the above tactics, the Province believed that the security of its tax base was threatened; hence, they turned towards non-tax instruments in order to capture rents.[44] The vehicle chosen was nationalization; although the Blakeney government set its specific objective as 50% of the industry, it set up the machinery to acquire 100% if it was deemed to be necessary. Suffice it to say that the province stopped after acquiring roughly 40% of the industry's productive assets. Immediately after passage of the enabling legislation (the Potash Development Act), the industry's opposition effectively capitulated.

Through the crown corporation, rents could be captured in the form of profits rather than taxes if the legality of the latter were challenged. The appeal of this approach was enhanced by the fact that provincial resource crowns, under the prevailing interpretation of Section 125 of the Constitution Act 1867, do not pay federal corporate income tax.[45] Hence, even that portion of rents which normally flow to the federal government could be captured by Saskatchewan through the use of a crown corporation.

In summary, a crown corporation theoretically facilitates the capture of 100% of the rents. They may then be recycled in the following manner: expand

the potash industry directly; provide for general government expenditures; or facilitate further diversification of the province through direct investment in other activities such as uranium and oil.[46]

Although the above analysis suggests that a crown corporation is a potentially useful vehicle for capturing rents, especially if the tax structure cannot be relied upon to perform this task, it also has limitations. For instance, it must be remembered that there is no guarantee that crown corporations will earn rents, let alone normal profits. This may be attributable to industry-wide problems or to firm-specific factors such as inefficiency. It may also be due to the rents being transferred to the prior owners through the initial purchase price.[47] A further issue is raised by the introduction of time into the analysis. For example, it is possible that the nationalization proceedings may be successful in the short-term, but not the long-run due to, say, inappropriate investment decisions. However, this argument has limited validity in the context of the potash industry where the prevailing cost and demand structure call into question the appropriateness of aggressive expansion policies. Furthermore, the actual experience of PCS suggests that it may, in fact, have been too biased in favour of expansion.

3.5 Conclusion

In this chapter I have outlined the province's attempts to tax the potash industry. Such revenues were shown to represent the primary benefits which the province receives from exploitation of its potash reserves. In the next chapter, it will be shown that the rents available for capture are, in fact, partially determined by the nature of the marketing system employed. Let us now turn to this subject.

FOOTNOTES

1. Meyer W. Bucovetsky and Malcolm Gillis, "The Design of Mineral Tax Policy", in Malcolm Gillis, et al, editors, Taxation and Mining: Non-fuel Minerals in Bolivia and Other Countries (Cambridge, Massachusetts: Ballinger, 1978), p. 97.

2. For discussions of the nature of rents, see Orris C. Herfindahl and Allen V. Kneese, Economics Theory of Natural Resources (Columbus, Ohio: Charles E. Merrill Publishing Co., 1974), Chapter 4; Harry F. Campbell, W.D. Gainer, Anthony Scott, "Resource Rent: How Much and for Whom?", in Anthony Scott, editor, Natural Resource Revenues: A Test of Federalism (Vancouver, B.C.: University of British Columbia Press, 1976), pp. 118-136; and R.D. Cairns, "Ricardian Rent and Manitoba's Mining Royalty", Canadian Tax Journal, Vol. XXV, No. 5, September-October 1977, pp. 558-567.

3. Further discussion of this phenomenon can be found in any standard public finance text such as Robin W. Boadway, Public Sector Finance (Cambridge, Mass.: Winthrop Publishers, 1979), Chapter 10.

4. Although thorough empirical studies of the indirect impacts of Saskatchewan-based potash developments were not found, a number of such studies have been undertaken on the province's uranium industry. Two of the better studies are: G.J. Holman, Impacts of Canada's Uranium Mining Industry (Calgary: Canadian Energy Research Institute, 1982); and Intergroup Consulting Economists Ltd., Socio-Economic Impact of Phase 2 of the Cluff Lake Project, A Report Prepared for Cluff Lake Mining, October 1982. These studies suggest that the backward and forward linkages of the uranium mining industry to the remainder of the provincial economy are rather meagre. There is no apparent reason for assuming that the potash industry exhibits stronger linkages.

5. For a discussion of neutral taxation, see Robin Boadway, Public Sector Economics (Cambridge, Mass.: Winthrop, 1979), pp. 215-218.

6. For a thorough discussion of the politics of the early years of potash development in Saskatchewan, see: Larry Pratt and John Richards, Prairie Capitalism: Power and Influence in the New West (Toronto: McClelland and Stewart, 1979), pp. 187-214.

7. Saskatchewan, Order in Council 2080/50.

8. Saskatchewan, Order in Council, 2276/53.

9. Saskatchewan, Order in Council, 769/56.

10. The crown royalty is paid by all producers (including the Potash Corporation of Saskatchewan) on all production deemed to have come from crown

lands. It should be noted that this levy is still technically in place although such payments are fully credited against the Potash Resource Payments Agreement (PRPA) liabilities; the mechanics and logic of the PRPA will be addressed below.

11. Saskatchewan, Order in Council 986/65.

12. Saskatchewan, Order in Council 1833/65.

13. This levy was effectively in force until 1 July 1979. It was paid by all producers including the Potash Corporation of Saskatchewan, on all production deemed to have come from freehold lands. It should be noted that this levy is still in place but has not been enforced since the Potash Resource Payments Agreement (PRPA) came into effect on 1 July 1979.

14. See Ronald C. Murray, Provincial Mineral Policies: Saskatchewan; 1944-75 (Kingston: Centre for Resource Studies, 1978), p. 43.

15. The fees were initiated through Saskatchewan, Orders in Council 825/72 and 1270/73. A political economy assessment of the resulting legal action can be found in Larry Pratt and John Richards, Prairie Capitalism: Power and Influence in the New West, pp. 294-300.

16. Saskatchewan, Order in Council, 1756/74.

17. This interpretation is to be found in David L. Anderson, The Role of Mineral Taxation in Industry/Government Conflict: The Case of the Saskatchewan Potash Reserve Tax (Kingston: Centre for Resource Studies, 1981).

18. For a discussion of the effective rate of marginal and average taxation faced by operators subject to the Reserve Tax, see Ibid.

19. For details, see Maureen Appel Molot and Jeanne Kirk Laux, "The Politics of Nationalization", Canadian Journal of Political Science, Vol. XII, No. 2, June 1979, pp. 227-258; and Jeanne Kirk Laux and Maureen Appel Molot, "The Potash Corporation of Saskatchewan", in Allan Tupper and G. Bruce Doern, Public Corporations and Public Policy in Canada (Montreal: Institute for Research on Public Policy, 1981), pp. 189-219.

20. The Potash Corporation of Saskatchewan pays all taxes levied on their private sector competitors with the notable exception of the federal and provincial Corporate Income Tax.

21. Saskatchewan, Order in Council 1788/79.

22. As a result of the PRPA, the government agreed not to collect the liability due under the Reserve Tax and the Producing Tract Tax; however, these levies remained in place and were, in fact, to be immediately applied to all producers if, in the government's judgement, the PRPA was broken. The crown royalty is collected but immediately credited against the PRPA assessment, hence, it was, in effect, temporarily recinded.

23. For discussion of this issue and the impact of recent constitutional change on the subject, see William D. Moull, "The New Constitution and Provincial Taxation", a paper presented to the Mining Law Institute, University of Saskatchewan, June 23-24, 1983.

24. See Footnote #1 for reference to the definition of economic rent employed in this study. Note that even if the incremental royalty is only levied on economic rent, the base payment applies independent of the firm's profit or rent generating ability.

25. The theoretical problems generated by non-neutrality are clearly outlined in Albert M. Church, Taxation of Nonrenewable Resources (Lexington, Mass.: Lexington Books, 1981). Problems such as high-grading, retarded development and inadequate exploration activity are not apt to occur in Saskatchewan in the foreseeable future due to the known magnitude of the reserves and the relative uniformity of the ore grade.

26. Patrick Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, unpublished Ph.D. Thesis, University of Toronto, 1980, p. 452.

27. From the perspective of neo-classical economic theory, this statement is of limited relevance since a tax on pure rent is neutral with respect to operating and investment behaviour. However, in practice, it is of concern - especially to the business and financial community. First, if firms are not perfect profit-maximizers, high marginal tax rates may lead to non-optimal output behaviour. This type of activity known as X-efficiency, was initially promulgated by Harry Lebenstein, "Allocative Efficiency vs. X-Efficiency", American Economic Review, Vol. 56, June 1966, pp. 392-415. For a brief, Canadian-based, natural resource discussion of this issue, see John F. Helliwell, "Comment", in Wayne R. Thirsk and John Whalley, Tax Policy Options in the 1980's (Toronto: Canadian Tax Foundation, 1982), pp. 296-297. The second problem is that it is exceedingly difficult to design a resources rent tax which restricts itself to the capture of rent. For details, see B.W. Wilkinson, Canada in the Changing World Economy (Montreal: C.D. Howe Research Institute, 1980), pp. 92-93.

28. Note that approximately 40% of the rent foregone by the Saskatchewan government when it substituted the PRPA for the Reserve Tax was recaptured through increased profits of the Potash Corporation of Saskatchewan.

29. Within eighteen months of the introduction of the PRPA, every producer had announced plans to expand their operations. However, due primarily to market conditions and, in one case, an adverse ruling by the Blakeney government on an expansion request, not all of these intentions have come to fruition.

30. At this time, it is highly unlikely that even so-called cheap incremental expansions would be commercially viable in a "no-tax" world, given

current selling prices for potash. However, as the data and discussion in Chapter 2 suggests, the situation was different in, say, 1980-1981. The prices prevailing at that time were sufficient, in the absence of a zealous tax system, to call forth major expansions - at least if such prices were expected to prevail over the length of the project.

31. See Table 14 for supporting evidence.

32. See Saskatchewan, Order in Council 1788/79, Potash Resource Payment Agreement, Appendix, Section 1.14(c)(V).

33. Although based only on hearsay evidence, it has been suggested by some observers that personal conflict between the then Minister of Mineral Resources and Noranda officials played a role in the negative decision. This view was promulgated by the Saskatchewan Mining Association in a press release issued at the time (September 1980).

34. See William D. Moull, "The New Constitution and Provincial Taxation".

35. Based on information in interviews with industry and government officials.

36. Mining companies constantly assert that their effective tax rate exceeds that of virtually all other industries. However, it is not necessarily a valid comparison: so-called resource rent taxes may be considered a factor payment (a charge for using society's resource base) rather than a traditional tax.

37. From an economic theory perspective, the "cash-flow" argument has little merit. However, from a pragmatic, political perspective, it is an important argument - especially in Saskatchewan. Given the events of the 1930's, virtually every Saskatchewan-based government has tried to budget for a small surplus over each electoral (4 year) period. However, in its first two years in office, the Devine government has accumulated a deficit of over $500 million; this is larger than the accumulated deficits since the formation of the province in 1905. It is quite clear that the current government is troubled by the potential political repercussions of this event and, hence, counter-cyclical, cash-flow tax systems have strong appeal.

38. See Albert M. Church, Taxation of Nonrenewable Resources.

40. Theoretically, investment decisions should be made on a project-specific basis. If the individual project meets conventional decision-critiria, then project-specific financing should be raised, based on the debt repayment ability of the project. In practice, debt/equity ratios and the like tend to be important; therfore corporate cash-flow, independent of new investment projects, tends to take on major importance.

41. This practice has previously been followed in Saskatchewan. Shortly after assuming office in 1964, the Thatcher government sought to stimu-

late the development of the mining industry by reducing the tax on mines commencing commercial production after this date. See Saskatchewan, Order in Council 1943/64.

42. The theoretical foundations of neutral rent taxation can be traced to E. Cary Brown, "Business-Income Taxation and Investment Incentives", in Income, Employment and Public Policy in Honor of Alvin H. Hansen (New York: Norton, 1948); and Paul A. Samuelson, "Tax Deductibility of Economic Depreciation to Ensure Invariant Valuations", Journal of Political Economy, Vol. 72, 1964, pp. 604-606. For a broader discussion of the concept, see Ben Smith and Alistair M. Ulph, "Economic Principles and Taxation of the Mining Industry: An Introductory Survey", in Ben Smith, editor, Taxation of the Mining Industry (Canberra, Australia: Centre for Resource and Environmental Studies, Australian National University, 1979), pp. 1-40.
However, there are several other aspects to tax planning than efficiency or neutrality. In fact, even if we strict the analysis to allocative efficiency conditions, there may be reasons for not wanting a neutral resource tax system. First, if, in the absence of the resource tax, output levels would be non-optimal, then optimal taxation would call for a distortionary tax. In the case of potash, if the natural outcome of the market would be destructive competition, triggered, in part, by over-expansion, then the tax system could be used to preclude such a result. This could call for a regime biased against expansion, rather than one that is neutral in this regard. Second, since the other tax levies are non-neutral, the introduction of a neutral resource rent tax may move the overall tax system further away from neutrality. The theoretical foundation of this argument rests upon the Theory of Second Best; see R.G. Lipsey and K. Lancaster, "The General Theory of Second Best", Review of Economic Studies, Vol. 24, 1956-57, pp. 11-32.

43. See Footnote #27.

44. A thorough discussion of this process can be found in John Richards and Larry Pratt, Prairie Capitalism: Power and Influence in the New West; and Maureen Appel Molot and Jeanne Kirk Laux, "The Politics of Nationalization", Canadian Journal of Political Science, Vol. 12, June 1979, pp. 227-58.

45. For a discussion of this issue, see Roy Romanow, "Provincial Crown Resource Corporations: Some Constitutional Issues", a paper presented to the Banff Conference on Natural Resources Law, 12-15 April 1983, pp. 23-25.

46. See John Cohen and Michael Krashinsky, "Capturing Rents on Resource Land for the Public Landowner: The Case for a Crown Corporation", Canadian Public Policy, Vol. 2, No. 3, Summer 1976, pp. 411-423.

47. Although it has been suggested above that crown corporations may be used to capture 100% of the rents, this is unlikely to occur if the govern-

ment takes over an existing operation. If the government pays the so-called "fair" market value for the asset, most, if not all, of the rent will be transferred to the private operator at this stage. On the other hand, if only normal profits are capitalized, the private owners may initiate court challenges and, at the very least, it will damage the domain's reputation as a safe place in which to invest. In other words, it may increase the political risk associated with future investment in the political unit attempting the takeover. For a good discussion of these issues, see John Richards and Larry Pratt, Prairie Capitalism: Power and Influence in the New West, Chapter 10.

CHAPTER 4 MARKET FAILURE AND CARTELIZATION

4.1 Introduction

It was previously stated that given the industry's supply and demand structures, the Saskatchewan potash industry not only maximizes its collective long-term profits when it acts as if it were a monopolist, but it also maximizes the net benefit to the Province of Saskatchewan. In order to secure this outcome the members of the industry must agree to a common pricing and output policy; that is, they must either formally or informally collude. Furthermore, since the consumers of potash are invariably non-residents, the province can be expected to implicitly approve of such an arrangement. Unfortunately, the manner in which they can do so is severely limited by constitutional, political and legal factors.

There is a long history of cartel activity in the mineral sector. In recent years, the OPEC cartel has been quite successful in increasing the magnitude of resource rents appropriated by member states.[1] The International Bauxite Association (IBA) has had a less certain effect, although Pindyck[2] and Caragata[3] suggest that it has been of assistance to its members.[4] On the other hand, similar initiatives in such areas as tin and copper have been singularly unsuccessful.[5]

Drawing heavily from Koch,[6] I shall now explore some of the factors which purportedly play a major role in determining the success of cartels.

4.2 Conditions Facilitating Collusion

4.2.1 Number of Sellers

Koch states that the fewer the number of potential sellers, the more likely cartelization is to succeed. Therefore, it is worthwhile noting that

over 40% of the world's potash exports originate in Saskatchewan; and that this province, along with the U.S.S.R. and East Germany collectively account for 78% of such sales. Within Saskatchewan there are only six producers, a number low enough to facilitate collusive behaviour. For example, it virtually assures that the actions of any one operator will have a noticeable effect on all others; this acts as an early warning device for purposes of triggering disciplinary action towards deviant members.

4.2.2 Demand and Cost Conditions

This is perhaps the single most important factor in determining the potential success of cartelization activities. Koch implies that the more similar the members are with respect to cost and demand factors, the less incentive there is for members to break away from the cartel or to attempt to "cheat". With respect to the latter factor, it is apparent that Sakatchewan producers face relatively homogeneous demand structures.

The off-shore market is such that it must be perceived in much the same way by each producer. The only exception may be PCS which might possess an advantage in dealing with such countries as China and India which display an affinity for government to government transactions. It is, however, in the U.S. market that the demand conditions, as perceived by each firm, may differ. Although potash is essentially a homogeneous product, the existence of long-standing buyer-seller relationships does pose a problem for new entrants, eg., PCS.[7] In other words, it takes time and resources to establish dealer networks and to become known as a reliable supplier. Hence, PCS must be viewed as a potentially deviant member of the industry, especially from a demand perspective; that is, it is the entity with the greatest incentive to operate independently. On the other hand, being a publicly owned

corporation, it is more amenable to governmental directives than its competitors.

The cost structure facing Saskatchewan producers is also relatively homogeneous - at least when viewed from a world-wide perspective. The ore grade, nature of the deposits, and even the vintage of capital are surprisingly homogeneous. Recall from Chapter 2 that the industry is characterized by high fixed costs and relatively low marginal costs (MC); hence, MC lies substantially below average total cost (ATC) up to the point of optimal plant design. The incentive now exists for a producer to sell more than its quota as long as perceived marginal revenue (PMR) exceeds MC. Unfortunately, if everyone acts in this manner, and if the industry demand curve is inelastic over the relevant range, then realized MR will be substantially less than PMR. The end result will be lower profits (or larger losses) for most, if not all, members of the industry;[8] even more disheartening is the fact that this situation may persit for a rather lengthy period since such firms will continue in operation as long as total variable costs, including necessary debt servicing costs, are covered out of period-by-period cash-flows. It is for this very reason that firms in such an industry have in the past explored the possibility of informal or formal collusive arrangements.

In summary, existence of the above demand and cost structure provides a strong rationale for the formation of single-seller agencies; on the other hand, it provides strong incentives for members to "cheat" and ultimately destroy the cartel. This discussion can also be relied upon to show the importance of controlling entry since new participants will attempt to operate as close to capacity as is consistent with $MR \geq MC$. If price cutting is practiced by the new entrant, it may trigger a general round of

destructive competition which creates accounting losses for all participants. Furthermore, as previously stated, it will be virtually impossible for the "old" firms to drive the "new" entrant out of the market through predatory pricing.

4.2.3 Product Differentiation

The greater the degree of product homogeneity, the more likely cartelization is to succeed. This proposition is based on the idea that if a cartel sells a single product, its pricing and output rules can be kept relatively straight-forward; this, in turn, makes it easier to obtain initial agreement and to monitor compliance.

Although there are four distinct grades of potash, each seller is viewed as supplying a homogeneous product. Indeed, Koch suggests that cartels are more likely to be successful in the natural resource area than in, say, the manufacturing sphere due to relative product homogeneity.

4.2.4 Price Elasticity of Demand

If demand is inelastic, then price competition leads to a decline in industry profitability, despite an increase in output. This creates pressure for carteliza ion, euphemistically called a return to "orderly marketing".

This discussion is clearly of relevance to the potash industry since potash demand is considered to be highly price inelastic, in the domestic market, in both the short and long-run.[9] This, in turn, is primarily attributable to the fact that there is no substitute for soluble potassium as a plant nutrient, and no close substitutes, from a resource cost perspective, for potassium chloride (KLC). This result clearly distinguishes potash from, say, oil, uranium or bauxite -- other areas in which relatively successful cartels have existed over a reasonable period of time.

4.2.5 Barriers to Entry

The more difficult it is for competitors to enter a market, the more conducive the market will be to successful cartelization. This follows from the fact that an aggressive new entrant peforms much the same role as a break-away or "cheating" cartel member: They capture a market largely at the expense of the remaining participants in the collusive arrangement. The latter must either acquiesce or compete; if it opts for the latter, it may dissipate rents.

In the potash industry, of barriers to entry are of two types. First, the capital intensive nature of the industry suggests that a minimum scale of operation calls for an outlay of at least $300 million -- more likely in excess of $500 million. Financial commitments of this magnitude act as a barrier to entry. Furthermore, with the exception of the Soviet Union, most of the world's low cost and large scale reserves are located in Canada.

Hence, Saskatchewan, acting on its own initiative, may exercise a major influence over world productive capacity. Nevertheless, other, albeit higher cost, deposits are amenable to development; this suggests that monopoly pricing power must be constrained so as to preclude destructive expansion of foreign-based deposits. This is important to the industry's long-run success since, once in operation, new entrants are exceedingly difficult to drive out of the market; they may lead to substantially reduced profits for cartel members.

4.2.6 Industry Stability

According to Koch, the more stable the industry, the less likely a cartel is to flounder. This supposition is based on the idea that changing market conditions create stress within the cartel. It may cause one or more

members to reconsider their decision to enter the scheme or provide new incentives to "cheat". Furthermore, changing conditions frequently require re-negotiation of marketing shares and pricing decisions -- all of which are contentious activities.

Undoubtedly, the potash industry has gone through significant instability in recent years. The major problem that it has faced is described in the following sub-section.

4.2.7 Depressed Economic Conditions

The prevailing view is that as economic conditions deteriorate, the incentives for collusion rise. This follows from the likelihood that industry members will eventually see that their efforts to gain a larger market share and to reduce unit cost by increasing output is largely self-defeating. On the other hand, an existing cartel may encounter internal conflict during a transition from a strong to a weak market; this follows from the expectation that the production cut-backs, which must occur in order to stabilize price and to clear the market, are difficult to implement in a non-discriminatory fashion. As previously stated, the incentives to "cheat" are high in such an environment. One only has to observe the difficulties which OPEC has had in allocating production shares in a declining market.

Applying this analysis to the Saskatchewan potash industry, yields the observation that the potentially destabilizing activities of PCS in 1981 and 1982 may have been attributable to deteriorating market conditions.[10] Since the corporation did not possess a well developed marketing structure in the U.S.A., it was forced to focus on the off-shore market. However, it was constrained therein by the presence of an industry-wide selling organization -- Canpotex -- over which it held limited control.[11]

The Blakeney government and PCS eventually decided that the crown corporation should leave Canpotex; however, the Devine government, immediately upon assuming office, mandated PCS back into the industry-wide sales agency. Nevertheless, PCS has pursued other activities, which may be somewhat destabilizing, such as the possibility of customer equity/long-term supply arrangements with China.[12] It is not clear how such ventures would be handled by Canpotex in terms of allocating production quotas. At the very least, it will cause stress within the organization.

4.2.8 Sealed Bidding

Despite reducing the possibility of patronage, sealed bidding is said to encourage collusive activity. It does so by reducing competition -- no one has a chance to respond to the so-called "low" bid. Furthermore, "cheating" is clearly identifiable since the lowest bid must be announced if the scheme is to have public credibility. Thus, rotation of "low" bids is facilitated by such a scheme. Sealed bidding is widely used in the off-shore potash market, especially if foreign-aid funds are involved.

4.2.9 Trade Associations

The existence of an active trade association facilitates cartelization; it provides a forum for the discussion of common "problems". In this regard, it is noteworthy that Saskatchewan potash operators have recently formed the Saskatchewan Potash Producers Association (SPPA).

4.2.10 Domestic Consumption

Although not discussed by Koch, it is likely that the lower the proportion of industry sales which are consumed domestically, the less likely it is for legal and political hurdles to arise. That is, if the product being considered for cartelization is largely exported, then limited welfare losses

will be incurred by consumers within the producing country. Indeed, cartels can be said to exist for reasons of ensuring that producers win and consumers lose. Hence, since approximately 95% of Saskatchewan potash is exported, it is reasonable to assume that, from Canada's perspective, the gains from cartelization will exceed the losses. It is, however, significant that the latter are borne primarily by U.S. and off-shore farmers (and the consumers of their crops).

4.3 Potential for Cartelization

From the prior discussion, it would appear as if the potash industry is a potential candidate for successful cartelization. This follows from the fact that it displays these characteristics: short and long-term price inelastic demand; economies of scale which prevail over the relevant operating range; no feasible substitutes; and a long-term supply curve which, in certain circumstances, lends itself to supply management schemes.[13] On the other hand, there are some limitations: strong incentives for "cheating" due to the fact that marginal costs (MC) lie substantially below ATC throughout the operating range; the existence of large, low cost reserves in the U.S.S.R.;[14] the apparent reliance by major competitors on foreign exchange earnings as opposed to profit-seeking objectives; the ever-present problem of keeping internal discord under control, especially with respect to output allocations; and, perhaps the most importantly, constitutional and political constraints. These limitations on Saskatchewan's market power are dealt with, in more depth, in subsequent sections of this chapter; they are denoted here in order to provide a better balance to the overall discussion of the feasibility of cartelization.

A review of the potash market-oriented literature reveals four studies which address the issue of restraint of trade activities. In 1973, Koepke[15] demonstrated that the potash industry has a long-tradition of engaging in collusive activities.[16] Nevertheless, he expected the 1970's to be characterized by declining producer power and growing competitive forces on the demand side.

This clearly did not occur, at least not on the supply side. For instance, no new mines were opened outside of the centrally planned economies; and as a result of the formation of PCS, reorganizations in Europe, and mine closures in the U.S.A., the number of sellers declined. As shown in Chapter 2, the market must now be described as highly oligopolistic. On the demand side, the trend towards fewer buyers has probably continued; however, workable competition most likely prevails. In the off-shore market, no change has occurred with national purchasing agencies continuing to dominate the market. For these reasons, it is difficult to accept Koepke's claim that although the potash industry has been historically plagued by collusive arrangements, it will be less so in the future.

As shown in Table 21, Caragata[17] found that on the basis of several criteria, the Canadian potash industry was ideally suited to the introduction of marketing arrangements which would exploit the province's latent market power. He places considerable reliance, for his policy prescriptions, on the relatively successful introduction of such a scheme in Saskatchewan in 1970; the details of this cartel style regulatory device will be presented in the following sub-section.

In an important theoretical paper, Olewiler and Flatters develop a promising framework for assessing the potential benefits from cartelization

TABLE 21

A Summary Assessment of Strengths and Weaknesses for Minerals Where Canada Possesses Some Leverage with its Major Trading Partners

MINERAL[1]	Large % of world reserves	Large % of world production	Dominance in major consuming markets	Little or no recycling	Little or no substitution	Not likely to be affected by special preferences for imports*	Not likely to be affected by ocean mining	Not affected by foreign stockpiles	Exports as a % of total Canadian exports (1977)
TANTALIUM	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Less than 1%
ASBESTOS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1.27%
CESIUM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Less than 1%
NICKEL	Partial	Partial	Yes	No	Some	Yes	No	Partial	2.3%
POTASH	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Yes	About 1%
ZINC	Partial	Partial	Yes	No	No	Maybe	Yes	No	1%
COBALT	No	No	Partial	Yes	Yes	No	No	No	Less than 1%
SELENIUM	Partial	Partial	Partial	No	No	Yes	Yes	Yes	Less than 1%

Source: Patrick James Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, (Unpublished Ph.D. Thesis, University of Toronto, 1980, p. 343.

in the Saskatchewan potash industry. Unfortunately, the empirical analysis is not based on "real world" data; however, the authors intend to do so in the next stage of their work. In summary, although the Olewiler and Flatters paper is of limited relevance to this study, it appears to represent the initial stage of a potentially rewarding approach for estimating the benefits, if any, from cartelization.

The final work to be reviewed is the most important one for purposes of this study.[18] John Richards,[19] in a wide-ranging study of the Saskatchewan potash industry, attempted to measure the amount of incremental economic rent that would have been generated by the total Saskatchewan potash industry if it had been operated as a public (or private) monopoly over the 1964-1977 period. He assumed that the Saskatchewan monopoly, called Sask. Pot, would act as a residual supplier: that is, the rest of the world (or competitive fringe as it is sometimes known) would supply whatever quantity it could consistent with its cost schedule, and the remaining market would be supplied by Sask. Pot so as to maximize its long-run profits. Given certain assumptions with respect to demand growth, an optimal expansion pattern for Saskatchewwan mines was developed; the pattern took into account the relatively long gestation period for mine construction; its indivisible nature with respect to scale; and a maximum "limit to greed" price. The model can be criticized for the amount of foreknowledge which is assumed to exist; a rather simplified tax structure; an overly passive reaction by competitors with respect to pricing, output and expansion decisions; and, of course, a lack of political opposition and retaliation by the U.S. government through either anti-trust or Congressional activity.

His findings suggest that if Saskatchewan had followed the monopoly model it would have gained between $700 and $1,700 million (1977 prices) in

incremental rents over the realized level of $475 million.[20] Although the modelling exercise is characterized by several short-cut assumptions which reduce the real world applicability of the results, the magnitude of the estimates clearly provides an a priori rationale for further governmental regulation. This follows from Richards' belief that it was the over-capacity phenomenon of the 1960's which largely accounts for the actual level lying so far below the potential quantity. Let us now explore how such a result came about in an industry with such a vast potential for rent generation and, equally important, discuss the policy response of the Thatcher government.

4.4 Prorationing

As previously noted, the Saskatchewan potash industry developed rapidly during the 1960's: 10 mines came on stream, increasing Saskatchewan's capacity to 7.57 million tpy K_2O. This represented an 75% increase in world productivity capacity. Although this remarkable growth, on its own, led to a situation of excess capacity, the problem was further exacerbated by large scale Russian expansion.

It must be stressed that all of the Saskatchewan capacity was constructed by private interests; much of it by firms with existing experience in the industry and in all cases by firms with extensive mining experience. In looking back it is hard to see how these firms could not have anticipated the ramifications of their actions. In part, the industry was thought to be about to enter a "take-off" stage; therefore, any short-term difficulties could be handled since they would be transitory. Second, the Thatcher government, in its desire for jobs and tangible evidence of success for its prodevelopment strategies, provided strong "positive" incentives for investment. Third, a relatively modest tax regime (approximately 2.5% of gross

revenue) was extended from 1974 to 1981 for all operators. All of these factors contributed to the aforementioned investment boom.

As a consequence of these actions, substantial excess capacity arose. Given that the mines are capital intensive and that demand is highly insensitive to price changes, attempts to utilize the new capacity led to a decline in selling price from \$41 to \$22/tK_2O between 1965 and 1969, respectively.[21] Although Saskatchewan producers continued to cover variable costs and some portion of their fixed costs, the cash-flow of some operators was insufficient to meet their combined operating and debt servicing costs.

Furthermore, the situation was continuing to deteriorate due, in large part, to a potash-related political crisis in the U.S.A. Unfettered competition in Canada had driven the price of K_2O to the point where the relatively high cost New Mexico producers were threatened with either massive lay-offs or complete closure. As expected, labour and capital interests united and their combined lobbying efforts led to several bills being placed before Congress to curb the importation of potash:[22] the real target was low-cost Saskatchewan product.[23]

After the case was taken up by the U.S. Tariff Commission, the Thatcher government decided to act: it instituted a floor price/production quota system which came to be known as the prorationing system.[24] Under the terms of the enabling legal apparatus, the Potash Conservation Regulations,[25] all producers were required to obtain a production license and to agree not to sell below a recommended floor price. Furthermore, they were required to join Canpotex in order to receive a full quota allotment.[26]

The basic parameters of the scheme came from an assessment of the operating and capital costs of both the Saskatchewan and New Mexico producers. It

appears as if the Saskatchewan government believed that it had to restrain output to the extent necessary to ensure that the New Mexico mines operated at close to full capacity and to ensure that, from an accountant's perspective, they were at least breaking even.[27] Secondly, the resulting price had to be high enough to ensure that Sasktchewan producers were at least covering operating and debt servicing costs at the chosen, restrained output level.[28] Supporting evidence is indirectly provided by Karvonen, one of the designers of the scheme:

> The mine is assumed to have been built at a cost of $83 million, with 70% per cent of the investment borrowed, and to have an annual productive capacity of 900,000 tons of K_2O equivalent. Mine operation costs, selling and administration costs, and interest and depreciation have been estimated for such a mine operating in 1969. It can be seen that such a mine, operating at approximately 50 percent of capacity would require an average selling price of $33.75 per ton of K_2O in order to break even ... at 1969 prices, that averaged $19.87 per ton of K_2O; a return on investment was impossible.[29]

Not suprisingly the floor price chosen was $33.75/st$K_2O$ and the quota system designed to yield an overall output level of approximately 50% of mine capacity. However, the initial base quota was set at 40% of each operator's theoretical capacity.[30]

The impact of the scheme was rather dramatic. In 1969 sales revenue, production and average price were $69.4 million, 3.4 million t K_2O, and $21.9/t K_2O, respectively. In 1970 the corresponding figures were $108.7 million, 3.2 million t K_2O, and $35.6/t K_2O; furthermore, a year later they were $144.9 million, 3.6 million t K_2O and $40.5/t K_2O.[31] These results were undoubtedly aided by a steady increase in demand over the 1969-72 period. In 1973, grain prices rose dramatically and thus the demand for potash escalated. Hence, by 1974 the industry's health had improved to such an extent that the prorationing scheme was essentially terminated.

Under the plan, the American producers prospered: the Saskatchewan floor price became the world price and the New Mexico producers, along with those in the rest of the world, were able to operate at close to full capacity. In summary, the cartel was successful, at least in the short-run, in that the Saskatchewan industry prospered; nevertheless, in many ways the primary beneficiaries were the "rest of the world" producers.[32] Indeed, the potash industry has been characterized by cartels throughout its history: the German cartel prior to WWI; the French/German cartel from 1924 to 1939; and the American restraint of trade activity in the 1940's to 1950's.[33]

There is another reason for continuing on with the prorationing example: to outline the federal/provincial powers in the regulatory area and to suggest possible institutional arrangements for cartelization which might meet the existing legal and political constraints. Briefly, in 1972, the newly elected NDP government altered the prorationing allocation mechanism by ignoring long-term commitments: prospective Saskatchewan sales were merely divided among producers according to their share of total industry productive capacity. All but one operator, Noranda Mines, appeared to support such a move.

Noranda, which ended up in the unusual position of having to purchase output from other producers in order to meet its sales commitments launched a legal challenge to the constitutional validity of the Prorationing regulations.[34] After the lower court judge found in favour of Noranda and the Saskatchewan Court of Appeal reversed the decision, the case reached the Supreme Court of Canada where, in 1978, the court ruled that the Potash Conservation Regulations were ultra-vires provincial powers.

The court found that the pricing arrangements amounted to an attempt to regulate external trade which was exclusively a federal power under the then

British North America Act 1867. Interestingly, the production control aspect appears to have been accepted as an attempt to manage and conserve (in an economic sense) the province's non-renewable resources.[35] Control of the latter is generally held to be a provincial power as spelled out in the above noted Act.

4.5 Current Marketing Arrangements

As has previously been stated, sales to the U.S. are made by individual producers, whereas off-shore sales are arranged through the Canadian Potash Exporters' Association (Canpotex). Not only is this dichotomy unusual, but it is applied in exactly the opposite manner from what economic theory would suggest. It is the U.S. market which bears the textbook characteristics for successful cartelization: short and long-run price elasticity of demand is exceedingly low; the buyer's market, while not perfectly competitive, appears to be characterized by workable competition; locational factors as well as production cost advantages give Saskatchewan producers a natural market; and the potential for United States-based output expansion is rather limited -- unless market prices were to escalate dramatically.

Alternatively, price and income elasticity estimates are much higher in the off-shore market; Saskatchewan does not enjoy transportation cost advantages, with the possible exception of the Chinese market; and ability-to-pay is severely constrained in most member countries. There are, of course, political and legal reasons for this perverse application of oligopoly theory, but the associated discussion will be postponed to the next section.

Despite the above portrayal of the market, it is quite possible that the U.S. market is, in fact, already characterized by some degree of informal collusion. The North American producers have been said to follow barometric

price leadership: an industry leader posts a price and the rest of the industry follows; if it does not, another "leader" surfaces and attempts to post the price -- eventually a reference point is established. Recent evidence suggests that PCS may by serving such a role; this is supported, in part, by its purported tendency to act as a residual supplier.[26] This outcome is consistent with at least two distinct theories of market behaviour. The first suggests that since PCS is the new entrant, it lacks a sophisticated U.S. marketing structure and, by implication, was forced to act as the residual supplier. The other view is that PCS is the residual supplier by choice -- it is part of dominant firm behaviour.

If the above scenario is a reasonable portrayal of present-day coordinated decisionmaking by Saskatchewan-based producers, it suggests that perhaps formal collusive arrangements will yield more limited benefits than Richards' analysis indicates. This is not to imply that his results are incorrect, but to suggest that perhaps the producers have learned by their mistakes in the 1960's; since then, they may have made pricing, output and capacity decisions with reference to the interactive effects of their initiatives.

Before concluding, two additional pieces of information should be presented. The obvious segmentation of the market in two spheres suggests recognition of the potential market power which they possess. Indeed, the f.o.b. mine price received in each market has varied significantly over time. In general, the U.S. market prices are much more stable than their off-shore equivalents.[37] Since it is widely believed within the industry that the U.S. market is more price inelastic, the adjustment is made on the output side; in contrast, excess supply is dumped in the more price elastic market -- off-shore. Indeed, it is said that PCS, and possibly one or more private companies, reacted against Canpotex's tendency to regard the off-shore market

as a dumping ground. In particular, PCS believed that such action might injure Canada's long-term ability to capture a significant proportion of this growth market.[38] Once again, this issue will be explored more deeply in the next section.

Finally, the recent formation of the Saskatchwan Potash Producers Association is consistent with Koch's view that such groups tend to arise during depressed economic conditions. It is widely known that a sharing of "market information", as it is euphemistically called, is a major objective of the SPPA.[39]

In summary, several pieces of circumstantial evidence exist to suggest that the performance of Canadian producers in the U.S. market, while not overtly co-ordinated, may operate in a manner quite different from that envisaged by the unfettered, perfectly competitive model.

4.6 Role for Government

Despite recent signs, at least by the producers, that expansion must be carefully monitored and that Canpotex should be strengthened, there continue to be valid reasons for suggesting a need for government regulation of the industry. The voluntary solution to requlation has the obvious limitation of being easily thwarted since the co-ordinating agency, either of a formal or informal nature, lacks effective sanctions.[40] Equally important, the collective goals of private firms may differ from those of the society within which they operate. More specifically, the government should possess the means for ensuring that new entrants, or new initiatives by existing operators, do not ultimately lead to a dramatic decline in price. Not only would such action injure present owners of capital, but also the state through lower tax revenues (and the overall dissipation of monopoly and resource rents through destructive competition).

Alternatively, a cartel may exploit its short and medium term advantage in a manner which maximizes the group's long-run profits. However, in doing so, they may drive up prices to such an extent that new higher-cost sources of supply enter the market. Over the longer term, this may reduce employment and tax receipts. On the other hand, evidence points to governments, rather than private firms, as being the primary proponents of rapid expansion. Although this may be partly justifiable so as to pre-empt expansion elsewhere (higher cost deposits), it is sometimes associated with political goals which can be roughly interpreted as "expansion-for-expansion sake" objectives. This short-term focus is partly attributable to the desire for increased employment, the stimulus and favourable publicity provided by any type of construction activity, and a desire to upstage one's political opponent. Unfortunately, as has been stressed throughout this document, this approach is rather short-sighted in an industry with cost and demand structures of the type applicable to the Saskatchewan potash sector.

The above discussion suggests that a voluntary sales agency such as Canpotex may not be able to represent the public interest over the long-term. As has been shown through its history, Canpotex has infrequently had all active producers in the fold at any one time. For a number of years Kalium and PCA refused to enter -- purportedly on grounds of fearing U.S. anti-trust action. It should be stated that the U.S. Justice Department appears to view mandated membership in a more favourable light than voluntary participation; hence, Canpotex membership could be imposed on operators through such instruments as a production lease or as a precondition to obtaining export permits.[41] Although PCS's proposed departure from Canpotex was stymied by the newly elected Devine government, the reasons for PCS's displeasure with the

voluntary sales agency are illustrative of the problems encountered by regulating an industry though voluntary associations. Essentially the problem can be traced to the difficulty of establishing rules and objectives which can simultaneously accommodate members who possess diverse corporate strategies. Recall that PCS is the new entrant: although it had taken over existing mines, it did not have as strong a U.S. marketing structure as its competitors. Moreover, since the expansion issue had been a critical element in the business/government confrontation of the mid-1970's, the Blakeney government strongly encouraged a major expansion by PCS. It was anticipated that most of the incremental output would have to be sold off-shore due to the relative maturity of the U.S. market and the above noted entry problem.

However, PCS found itself frustrated by Canpotex. Although, through contract refusals by other members, PCS was able to eventually fulfill up to 50% of Canpotex's sales requirement; it possessed only 1 vote out of 7 in the decision-making structure. The crown corporation thought that Canpotex was acting too much as a residual supplier; that it was maximizing short-run profits at the expense of capturing a larger market share which could lead to an improved long-term position with respect to both employment and profits. In particular, PCS, as apparently did one or two other members of Canpotex, believed that the Chinese market was not being pursued with enough zeal and through proper techniques. PCS wanted demonstration projects, the provision of low cost product to facilitate early usage, and the use of innovative financing mechanisms such as countertrade and, perhaps, customer equity schemes.

Although PCS's concerns appear to have considerable merit, they were clearly motivated by self-interest: a desparate need to sell product from

their rapidly expanding productive capacity -- to do otherwise could have led to a major political embarrassment. On the other hand, it would appear as if the U.S.-based producers did view the U.S. market as the focal point of their activity. They viewed the off-shore market as a convenient place in which to "dump" excess product.

It would appear as if PCS's re-entry has triggered a change in Canpotex's mode of operation. The Chinese market, in particular, is being aggressively pursued. In general, the producers appear to now subscribe to the view that any expansion must be directed towards this part of the world. The change of heart may have been triggered by economic necessity. The 1981-82 recession led to large scale cut-backs in U.S. potash applications; this, in turn, increased the attractiveness of the off-shore market.[42] Further reflection appears to have led to the acceptance of the view that this change in direction should be a long-term, not just a short-term goal.

Since the LDC markets are generally characterized by higher price and income elasticities than those found in DC's, the optimal marketing strategy may differ. For instance, it is possible that Saskatchewan producers should aggressively pursue new markets in order to pre-empt competitors, to generate more employment and to increase its market share which may eventually be exploited to Saskatchewan's advantage.[43]

In essence, a shift from being a residual supplier (following cartel type, monopolistic pricing and output tactics) to an aggressive "competitor", at least in the short term, was being advocated by PCS. The "market-share" model may be rationalized on price competition grounds since Saskatchewan is the low cost producer. This, however, ignores the fact that profit seeking activity may not be the primary object of many of our competitors. For

example, if the U.S.S.R., East Germany and Israel primarily pursue foreign-exchange earnings, then price competition may not be a very effective method of driving them out of the market. Instead, the market-share model may merely lead to a dissipation of rents. However, a limited degree of short-term competitive behaviour is not inconsistent with longer-term rent maximization behavour: cartels are more effective the larger the market share one possesses. Hence, short-term, price competition may be a prerequisite to longer-term cartel behaviour. Furthermore, aggressive price competition in the short-term may preclude "rational" expansion elsewhere which facilitates long-term rent maximization.

A further problem with the aggressive "market-share" approach is that it may lead to massive disparity between the f.o.b. mine price of product destined for the U.S. and that shipped to the off-shore market. Although this has sometimes been the case, the price spread has never been large enough to attract U.S. governmental or farm-lobby interest. However, the above described activity could do so. If, in order to preclude retaliatory action, prices are lowered in the U.S. market, then this cost, in the form of foregone revenue must be attributed to the "competitive" off-shore strategy. This further calls into doubt the benefits of the rapid expansion policy which has had currency under both the Blakeney and Devine provincial governments.

In summary, current information and data are not adequate to allow one to conduct analytical work on optimal rent maximizing strategies. For example, short and longer-term price elasticities are said to be much higher in the LDC as opposed to DC realm; however, how much higher are they?; is the absolute number elastic or inelastic? Similar questions can be posed with

respect to income elasticities. This suggests an important area for further research activity. Not only would the answers help establish rent maximization strategies, but they would also facilitate the determination of the nature of the trade-off relationship between employment and rent generation. In many respects, this is the fundamental policy issue which must be addressed in the determination of an appropriate expansion strategy.

The above discussion indicates that the stress on Canpotex may not be over; the appropriate development strategy is not intuitively obvious. A final example of Canpotex's problems is the failure of PCA to place its new mine in New Brunswick under the Canpotex umbrella; similar decisions may be made by Denison and British Petroleum when their New Brunswick properties are brought on stream. If this takes place, it may create a situation wherein Canadian producers trigger a price-war among themselves; the outcome would be that foreign consumers would win and Saskatchewan and possibly New Brunswick citizens, and investors therein, lose. This problem is, once again, attributable to new entrants possessing different objectives from existing operators. The former may wish to establish a market share before colluding; but if they infringe "too much" on Canpotex's (or other) markets, the existing arrangement quickly collapses, with all producers losing. This issue is further complicated by the New Brunswick government's desire for rapid development so as to generate jobs and tax revenue. Even if they were willing to enter Canpotex, the process by which production shares are allocated could become extremely contentious -- it might even lead to the departure of one or more existing members.

This analysis suggests that even if one ignores the U.S. market, the inter-provincial nature of the problem, as well as the external trade issues

involved, might require federal government participation. This would most probably be of the form of requiring, either directly or indirectly, mandatory membership in a national sales agency. It should be clear that not only is it possible for individual private sector interests to conflict with the industry-wide rent maximization strategies, but so might that of one or more provincial governments.

One further point should be raised: all discussions with respect to alternative market arrangements focus on the off-shore market. However, it is the U.S. market which displays the characteristic which would suggest that this is the market which is ripe for cartelization. Although the oligopolistic nature of the industry implies that some activity in this realm is probably already taking place, significant potential for capturing incremental rent would appear to exist.[44]

The current policy paralysis is largely attributable to two factors: corporate fear of anti-trust and congressional action and governmental concern about the impact such an initiative would have on U.S./Canada relations. The former can be handled by government imposed membership in a Canpotex-style organization or through other mechanisms to be discussed in the next section. However, the real problem has always boiled down to a concern that if Canada exploits its natural advantage in potash, it may gain in the short-run but lose in the more distant future: retaliatory action could be unleashed which would hurt Canada more than the U.S. This fear is not irrational but has precluded virtually any thought to improving, even moderately, the return from sale of Canada's potash resources in the U.S.A.

4.7 Constitutional Issues and Resource Management

Throughout the text, I have suggested that there may still be a role for provincial government regulatory regimes, possibly along the lines of the

pro-rationing model which was declared ultra vires by the Supreme Court of Canada in 1978. Let us now explore the issue of constitutional limitations on regulatory regimes, with particular reference to the June 1982 constitutional amendments.[45]

The revised Constitution Act 1867 provides Saskatchewan with the ability to regulate production on domestically traded goods as long as uniform inter-provincial pricing policies are adopted. It is not entirely clear if regulatory regimes directed towards exported commodities would be interpreted in a similar fashion. The prevailing view appears to be that as long as marketing arrangements are restricted to output controls, then they are likely to be intra-vires provincial powers; thus regulatory regimes based on both price and quantity controls would probably require some degree of federal government involvement.

One recent constitutional change unambiguously helps the provinces in their resource management exercise. Until the 1982 reforms, the provinces were restricted to using direct taxation instruments. Relying upon John Stuart Mills' definition, the courts have generally held a tax levy to be direct if it is meant to be borne by those upon whom it is legally levied. Alternatively, an indirect tax is one which is expected to be passed on to a third party instead of being borne by those liable for payment to the crown.

This dichotomy led to many problems, including the finding in the CIGOL case that Saskatchewan's crude oil taxation system was ultra vires provincial powers. This decision spurred the province to design a number of rather ingenious tax instruments. In the case of the PRPA, for instance, individual contracts were signed with the mine operators to ensure that the tax payment would be viewed as a payment for service rather than an indirect tax.[46]

The need for such complex arrangements has now been eliminated with the removal of the direct/indirect tax distinction for the non-renewable resources area. Although this may seem unrelated to regulatory regimes, it is not since, until this change in the constitution, one method of challenging the constitutional validity of a regulatory regime was to claim that it acted as a tax on production and hence was an indirect levy and thus ultra-vires provincial powers. This avenue of recourse has now been removed by the above noted constitutional amendment.

4.8 Policy Responses

The above discussion has called into question the wisdom of the current emphasis on expansion and the trend towards deregulation in an inherently unstable industry. First and foremost, better information must be obtained on the demand structure facing the industry, and on the motivational factors affecting competitors from other parts of the world. Furthermore, although Canpotex appears to be operating successfully as a voluntary organization at this time, reasons have been provided for suggesting that more stringent requirements may be required in the future. These could be enforced by making membership in Canpotex a condition of obtaining and possessing a production lease. Alternatively, given the inter-provincial problems arising due to the emergence of New Brunswick as a major producer, federal action may be necessary to force all producers into Canpotex or an equivalent structure. This could be achieved through federal export powers; for example, formal approval could be required for all export shipments. This system could, for instance, give automatic approval to Canpotex contracts but require case-by-case review of non-member sales agreements. The operating model could, for instance, be the National Energy Board (NEB) or the Uranium

Export Review Panel. Furthermore, a government run marketing agency, along the lines of the Canadian Wheat Board, should be explored for potential use if the environment were to abruptly change.

The analysis also stresses the inter-relationship between taxation and expansion policies. As noted in Chapter 3, the Government of Saskatchewan is considering an industry submission which calls for moderation of the tax structure in order to encourage expansion; however, the contents of this chapter call into question the wisdom of this course of action. Given that the major benefits to the province from potash development are expected to be captured through the appropriation of economic rent, a reduction in taxes, without expansion, could then result in merely a transfer of such rents from the public to the private sector. With expansion, the results could be even worse: not only may rents be transferred in the above noted fashion, but they may decline in absolute value over the foreseeable future. This suggests that the province closely monitor its proposed tax changes and acquire detailed information on the economic structure of the potash industry.[47]

At the present time, an interesting policy response is taking place. PCS, with explicit governmental approval, is attempting to encourage customer equity in its mining activities. To some extent this is designed to allow current expansion plans to continue to fruition.[48] However, it has the potential to address some of the issues raised in this report. Customer equity schemes provide for a potential buyer of the product to acquire a share of the equity in return for a payment and an agreement to take a share of the mine's output. Hence, it is a hybrid investment/long-term contract. It has the obvious benefit of securing long-term markets without engaging in explicit price competition; hence, it can be used as a form of non-price competition -- the classic tool of an oligoplist. For instance, such schemes

can be used to disguise the effective price of the sale through under- or over-provision of investment funds. Thus, it may represent a useful way for Saskatchewan to reduce the employment/rent trade-off: expansion occurs with a minimal effect on the rest of the market. In economic terms, a base load is obtained, which increases the profitability of incremental sales.

Nevertheless, competitors may respond in kind - the U.S.S.R. being the most likely participant. Furthermore, as the Australians have found in coal, bauxite and iron ore, customer equity is a mixed blessing: it provides the buyer with detailed financial information and may lead to substantial rents being transferred of the country through the foreign-ownership vehicle.[31] However, the benefits suggested that in the case of potash a much greater reliance on customer equity, especially in partnership with a government entity, should be encouraged in this industry. Let us now summarize our analysis and present the major recommendations of this study.

FOOTNOTES

1. For example, see Jacque Cremer and Martin Weitzman, "OPEC and the Monopoly Price of World Oil", European Economic Review, Vol. 8, August 1976; and S.D. Krasner, "Oil is the Exception", Foreign Policy, Vol. 14, 1974, pp. 68-84.

2. Robert S. Pindyck, "Cartel Pricing and the Structure of the World Bauxite Market", Bell Journal of Economics, Vol. 8, No. 2, Autumn 1977, pp. 343-360.

3. Patrick Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, Ph.D. Thesis, University of Toronto, 1980.

4. See Canute James, "Bauxite Organization to Study Performance", Globe and Mail, Toronto, 10 December 1983, p. (B19).

5. See Robert S. Pindyck, "Gains to Producers from the Cartelization of Exhaustible Resources", Review of Economics and Statistics, Vol. 60, No. 2, May 1978, p. 249.

6. James V. Koch, Industrial Organization and Prices (Englewood Cliffs, N.J.: Prentice-Hall, 1980), Chapters 12, 13.

7. This issue, in the context of PCS, is discussed in June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan, unpublished Ph.D. Thesis, University of Toronto, 1982.

8. A good, elementary discussion of this subject can be found in F.M. Scherer, Industrial Market Structure and Economic Performance (Chicago: Rand McNally, 1980), pp. 205-212.

9. See Chapter 2, Section 2 for a discussion of these issues.

10. See June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan, for development of the PCS/Canpotex relationship.

11. Ibid.

12. See Dale Eisler, "China Offered Potash Deal", Leader-Post, Regina, 17 October 1983, p. (A4); and John Twigg, "Financial Column", Leader Post, Regina, 8 October 1983, p. (B10).

13. See Chapter 2, Section 3 for a discussion of supply curves.

14. Recall that it was previously (Chapter 2,3) stated that the U.S.S.R.'s actions are extremely difficult to anticipate. If they exploit the mar-

ket to its full potential, the long-run supply curve could be rather elastic; if they operate as they have in the past, then the non-Canadian long-run supply curve may be rather inelastic over the relevant operating range.

15. W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, Energy, Mines and Resources Canada Report MR 139 (Ottawa: Information Canada, 1973).

16. Indeed, W.C.J. Van Rensburg and Susan Bambrick, The Economics of the World's Mineral Industries (Johannesburg: McGraw-Hill, 1978), p. 206, suggest that such a situation possibly existed in the late 1970's.

17. Patrick Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, Chapters 6, 7.

18. Frank Flatters and Nancy Olewiler, "Dominant Government Firms in an Oligopolistic Industry: The Case of Saskatchewan Potash", CRS Working Paper No. 29, Centre for Resource Studies, Kingston, Canada, February 1984.

19. John Richards, Primary Industry and Regional Development: Potash in Saskatchewan, unpublished Ph.D. Thesis, Washington University, St. Louis, August 1982.

20. Ibid., p. 11a.

21. See Table 13.

22. The former lobby was rather slow in reacting to the effects of prorationing. Although the U.S. Justice Department eventually instituted Anti-Trust proceedings against a number of participants in the prorationing scheme, the action was dropped shortly after the 1976 Presidential election. Indeed, some observers suggest that the judicial action was merely an attempt to win farm votes by the Republican Party. For details, see June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan; and John Richards and Larry Pratt, Prairie Capitalism: Power and Influence in the New West (Toronto: McClelland and Stewart, 1979).

23. See Patrick Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, Chapter 7, for an interesting presentation of the background issues, related to the development of the prorationing scheme.

24. D.A. Karvonen, "The Saskatchewan Potash Prorationing and Price Stabilization Program", CIM Bulletin, April 1973, pp. 1-6.

25. Saskatchewan Regulations 287/69, Order in Council 1733/69, Saskatchewan Gazette, 21 November 1969.

26. See D.A. Karvonen, "The Saskatchewan Potash Prorationing and Price Stabilization Program", pp. 4-5.

27. Ibid., pp. 2-3; and John Richards, Primary Industry and Regional Development: Potash in Saskatchewan.

28. According to Ibid., some Saskatchewan-based producers were threatening to close if remedial action was not taken.

29. D.A. Karvonen, "The Saskatchewan Potash Prorationing and Price Stabilization Program", pp. 2-3.

30. For more details on the scheme, see Ibid.; Patrick Caragata, Non-Fuel Minerals and Canadian Foreign Policy: Negotiating from Strength and Weakness, Chapter 7; and William D. Moull, "Natural Resources: The Other Crisis in Canadian Federalism", Osgoode Hall Law Journal, Vol. 18, No. 1, March 1980, pp. 2-43.

31. See Table 13.

32. This view is held by John Richards and Larry Pratt, Prairie Capitalism: Power and Influence in the New West, (Toronto: McClelland and Stewart, 1979).

33. W.E. Koepke, Structure, Behaviour and Performance of the World Potash Industry, Appendix II.

34. This discussion draws heavily upon William D. Moull, "Natural Resources: The Other Crisis in Canadian Federalism", pp. 2-43.

35. For a dissenting view, see A. Paus-Jenssen, "Resource Taxation and the Supreme Court of Canada: The Cigol Case", Canadian Public Policy, Vol. 5, No. 1, Winter 1979, pp. 45-58.

36. For a discussion of this issue, see June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan.

37. See Table 11 for supporting evidence.

38. See June Corman, The Impact of State Ownership on a State Proprietary Corporation: The Potash Corporation of Saskatchewan; and interview with David Dombowsky, former President of PCS, as reported in "PCS Looks to its Future Following its Break with Canpotex", Phosphorus and Potassium, No. 116, November/December 1981.

39. Based on interviews with industry and government officials.

40. An alternative is for the relevant governments to officially sanction cartel arrangements, provide encouragement for all to join, and then let the organization operate as a "voluntary", privately controlled entity.

However, all participants will clearly understand that collapse of this arrangement will lead to a government controlled unit. In some ways, this approach parallels the environment surrounding Canpotex.

41. Note that the Province of Saskatchewan controls the issuing of leases whereas the Government of Canada has constitutional power over all matters related to external trade.

42. The resulting activity provides circumstantial support for the prevailing view that the price elasticity of demand for potash is much more elastic in the off-shore than the domestic market. For details, see Chapter 2.2

43. The importance of the market share argument to the successful operation of a cartel can be found in Robert S. Pindyck, "Gains to Producers from the Cartelization of Exhaustible Resources".

44. An alternative view is possible: that the demand for potash is quite sensitive to its own price. Proponents of this view would explain current output and pricing behaviour as being institutionally determined. That is, in order to avoid the threat of U.S. anti-trust laws and Congressionally inspired tariff or non-tariff barriers to trade, Saskatchewan producers ensure that prices are kept high enough to allow New Mexico producers to operate at reasonable output levels. Although this view is inconsistent with recent mine closures in New Mexico, it is consistent with a long-term, minimal disruption policy. If this scenario is correct, a possible policy option is for Saskatchewan producers, individually or collectively, to purchase New Mexico production at a price consistent with normal profits and to then expand the market and their profits through price competition. Given the state of available empirical evidence, it is not possible to completely rule out this view of the world; nevertheless, casual empiricism supports the scenario associated with the presence of a price inelastic demand for potash.

45. This discussion is heavily based on the work of William D. Moull, "Section 92A of the Constitution Act", Canadian Bar Review, forthcoming.

46. This approach was adopted to avoid the legal problems associated with indirect provincial taxation; the recent amendments to the Constitution Act 1867 have, of course, removed this troublesome legal problem. For details, see William D. Moull, "The New Constitution and Provincial Taxation", a paper presented by the Mining Law Institute, University of Saskatchewan, June 23-24, 1983.

47. Even if one suspects that the relevant demand and supply elasticities are much more elastic than that suggested by conventional wisdom, the proposed course of action should still be followed; at least until one has strong evidence that an expansionary policy is appropriate. This follows from the irreversible nature of expansion: if it turns out that the conventional wisdom is correct, then the new capacity may only lead to destructive competition and, hence, to the dissapation of rents.

48. See Dale Eisler, "China Offered Potash Deal".

49. For a discussion of the issues, see Australia, Foreign Investment Review Board, 1981 Report (Canberra: Australian Government Publishing Service, 1982), Chapter 5; and David L. Anderson, Foreign Investment Control in the Mining Sector: Comparisons of Australian and Canadian Experience (Canberra: Centre for Resource and Environmental Studies, Australian National University, 1983), pp. 156-163.

CHAPTER 5 RECOMMENDATIONS AND CONCLUSIONS

5.1 Summary

At first glance it appears as if the potash industry should be able to play a critical role in the future economic development of the Province of Saskatchewan: its value added contribution per unit of output is significantly above the national average; the province's mines are generally considered to be the world's low cost producers; and Saskatchewan reserves are the largest in the world. This might suggest that public policy should be directed towards encouraging a rapid expansion of the industry.

Nevertheless, the analysis contained herein implies that such an approach is highly questionable given the specific characteristics of the potash industry.[1] First, let us reconsider the contribution of value-added to the province's economy. Although value-added (VA)[2] constitutes roughly 85% of industry sales, labour's share is only 10 to 15% of VA; translated, this means that the potash industry is highly capital intensive. Even if the industry were to double in size, it would only create an aditional 3,000 to 4,000 permanent jobs. However, it must be stated that the short-term effect generated by the associated construction activity would be much larger. Furthermore, the total effect is not apt to be significant due to the virtual absence of provincially-based backward and forward linkages.

It follows that the proportion of VA captured by either the owners of capital or the state must be high by conventional standards. However, given the magnitude of non-resident ownership, which was 100% prior to 1976 and now resides at approximately 60%, the potential for leakage is high. The magnitude of the effective rate of leakage can be reduced over the medium term by expansion activities financed through retained earnings. However, there is

some question as to how much Saskatchewan should or even want large-scale expansion by an industry presently operating at 60-65% capacity.

This leaves two major rent capturing vehicles: government-owned enterprise and taxation. The former played a major role in the Blakeney government's policy package but has economic and political problems of its own. It is possible that the property will not generate rents and, indeed, may not even generate a cash-flow sufficient to cover debt repayment and a normal rate-of-return on equity. It is also possible that such enterprises will operate less efficiently than privately owned firms. Finally, there are philosophical and ideological objections to crown corporations which largely place this instrument outside of the feasible policy set of the Devine government.

The above factors lead to the conclusion that the primary benefits to the host domain are derived from the collection of taxation receipts. Hence, the capture of economic rent is the major method by which the province can expect to benefit from non-renewable resource development characterized by high capital intensity and low backward and forward linkages.

In most situations, tax instruments should be economically neutral:[3] in this manner expansion and operating decisions are unaffected by the tax system; but yet the state may capture a substantial proportion of the rent attributable to ore body characteristics. Unfortunately, it has proven to be extremely difficult to design resource rent taxes which are both neutral and administratively feasible; nevertheless, they serve as a useful reference point. Although both the Reserve Tax and the PRPA were undoubtedly non-neutral, and the former perhaps confiscatory in nature, they represented a movement towards the use of profit-sensitive, rent capturing devices. This

discussion of neutrality is, of course, politically naive: it is during weak economic conditions characterized by large deficits, that governments are least able to forego taxes. On the other hand, in buoyant times, taxes may be more easily reduced due to the lower political cost of the action. Hence, economic policy conflicts with sound rational political strategy.

Other reasons for violating the neutrality principle abound: the equity principle suggests that in bad times everyone should contribute to the provision of the necessary merit and social goods required to aid the disadvantaged, even if this result in some loss of efficiency. Furthermore, since the remaining elements of the tax system are known to be non-neutral, the theory of Second Best tells us that the introduction of a neutral resource tax does not necessarily move the overall system closer to neutrality.[4]

It must also be stressed that the tax system may be used to pursue non-revenue objectives. For example, if the economic system is characterized by elements of market failure, then the tax system can be used as a corrective device to aid in the pursuit of market efficiency and the maximization of society's welfare. The purpose of this dialogue is to remind the reader that the possibility of destructive competition exists within the K_2O industry;[5] since this can be initiated either through the construction of new plants or the simultaneous desire by all producer to operate existing mines beyond the level consistent with industry-wide profit-maximizations. Fortunately, the tax system may be designed to counteract these perverse outcomes.

The nature of destructive competition was discussed at several points in the text. This phenomenon is due, in part, to the presence of a demand curve which is inelastic over the relevant operating range. Hence, small reductions in price have little impact on a surplus and, alternatively, in periods

of strong demand, prices may have to rise substantially in order to restore market equilibrium. This result is partially attributable to a lack of close substitutes for KCL as a plant nutrient. A second critical ingredient in the destructive competition scenario is generated by the industry's cost structure. It is characterized by significant economies of scale throughout the relevant operating range. The resulting large-scale investment and limited employment means that variable costs lie significantly below total average costs. Even at utilization rates of 80 to 90%, the corresponding figure would be less than 50%.

A possible solution to the potash industry's inherent tendency to dissipate rent is for it to operate as if it were a monopolist. More specifically, such an entity might let the competitive fringe have its market share consistent with its cost structure, and then treat the residual market as if it were a profit-maximizing monopolist. The impact on the individual Saskatchewan-based producer is likely to be lower output and high profits; to the state it should mean the capture of more tax revenue albeit at the expense of employment. Hence, the state must trade-off direct employment for the benefits of recycled rents and incomes.[6]

Such schemes tend to be unstable unless the number of participants is small and each member can see that it is in their interest to remain in the group. There are always incentives to leave the cartel since at prices slightly below the cartel level, any one firm could expand output and increase profits. However, if everyone follows suit, all firms end up with essentially their initial market shares and lower revenues.

Despite the fact that a buoyant market situation presents the monopolist with an ideal situation for capturing rents, it may be in Saskatchewan's

interest to ensure that the supply situation does not become too tight: this follows from the fact that if prices are allowed to rise too much, higher cost deposits in other domains will now become profitable and will be brought on stream. This, in turn, will pre-empt Saskatchewan expansion which would have yielded higher rents due to its lower cost structure and it may trigger a round of destructive competition as described above. The new entrants, although high cost producers, will continue to operate as long as they cover their variable costs. Thus all producers may suffer accounting losses or reduced profits over an extended period. In other words, additional capacity, once in place, will be extremely difficult to drive out of the market; this result is reinforced by the tendency of some of the prospective entrants to follow non-profit maximization goals. Although one might argue that such a situation is self-correcting in the long-term, such a period for the potash industry may be to 20 to 40 years. During this time, rents are being squandered and the VA contribution to the province will be less than it would otherwise be.

It is also recognized by industrial organization specialists that the greater the so-called competitive fringe, the more difficult it is to introduce effective market stabilizaton arrangements. This presents the policy-maker with a quandary. It is in Saskatchewan's interest, as a dominant world exporter, to restrict supply and exploit its market power. However, without maintaining its market share, its power-base can be eroded. Furthermore, a focus on short-term profit maximization can lead to the enticement of new entrants into the market which not only capture markets which could be more efficiently applied from Saskatchewan but may lead to over-supply and hence destabilizing activity of the sort described above.

This discussion has direct relevance to the current policy debate in Saskatchewan. For instance, a reduction in taxes without concomitant expansion leads to a transfer of rents from the public to private sectors. Furthermore, the share of value-added remaining within the province declines due to the presence of approximately 60% non-Saskatchewan ownership. On the other hand, reduced taxation, coupled with strong incentives for expansion, can lead to over-supply and hence to dissipation of rents. The quandary can be resolved by ensuring that any reduction in taxes be in the form of a refinement to the system. For instance, the regressive features of the levy could be eliminated; the X-efficiency problems could be addressed by reducing the maximum marginal tax rates; and the system could be made to be more neutral as long as it is consistent with other objectives of the state. To bias the system in favour of expansion is highly questionable from an economic perspective: indeed, the industry's structure suggests that a neutral system, with the potential to shift to an anti-expansion mode if necessary, would be the best scheme for the province to adopt.

The preceding point requires elaboration. Although the thrust of this paper suggests that output and capacity should be closely monitored, it must be stressed that the assumptions which underly the analysis are extremely tenuous. That is, the conventional wisdom, with respect to the price and income elastiticities of demand, has been adopted in this study. However, given the paucity of rigorous empirical research on the subject, other outcomes are clearly possible. If this were to be the "true" situation, it might follow that an aggressive, price-cutting, output expansion approach should be utilized in, say, the U.S. market. Nevertheless, unless one felt strongly that this was the correct approach, it would still be appropriate to

adopt the strategy recommended herin until definitive studies were conducted. This statement follows from the irreversible nature of the expansion strategy. As previously noted, potash capacity, once constructed, almost invariably, will remain in use for the physical lifetime of the project. This follows from the fact that potash mines are "highly" capital intensive; hence short-term marginal cost lies well below the corresponding average cost which, in turn, suggests that it will be extremely difficult to drive anyone out of the market through price competition. Thus, unless demand is relatively sensitive to price, destructive competition could result, and, hence, the dissipation of Saskatchewan-based rent.

The summary presented above, along with the detailed comments in the preceding chapters, generates a number of policy implications.

5.2 Policy Implications

The policy implications presented for consideration by public policy decision-makers are as follows:

(i) Policy formulation should place greater emphasis on the potash industry's underlying market structure. Recent governmental initiatives appear to be based on the assumption that the industry is competitive in both its supply and demand markets. However, the available evidence suggests that the industry is characterized by oligopolistic structures.

If the latter is indeed the prevailing organizational form, attention should be directed towards the determination of optimal capacity and utilization rates and the appropriate market arrangements for maximizing the net benefits from the exploitation of Saskatchewan's potash reserves.

(ii) Taxation of the potash industry should be based, in large part, on the premise that the primary benefit from potash extraction, to the citizens of Saskatchewan, accrues in the form of tax revenue. More specifically, it flows from the capture of economic rents which, under appropriately designed systems, can be done without affecting investment or output behaviour.

(iii) In designing taxation schemes for the potash industry, due recognition must be given to the inter-relationship between taxation, industry expansion, and potentially destructive competition. For example, added incentives for expansion offered through the tax system may lead to destructive competition. Given that the demand for potassium chloride is thought to be highly price inelastic, profits and taxes may decline. In other words, lower output levels, although sacrificing employment, may lead to a healthier industry and higher tax revenues. Rephrased, the simplistic argument that lower taxes leads to greater economic activity and ultimately larger absolute tax receipts must be severely questioned in the context of the potash industry.

(iv) The economic characteristics of the industry suggest that a uniform selling agency should handle all off-shore sales. In this regard, the decision by the Devine government to force PCS to remain within Canpotex was appropriate from an economic efficiency perspective. Similarly, it should continue to encourage all producers to remain within this "voluntary" sales agency.

(v) If evidence is found of either destructive competition or the exploitation of Canadian producers by oligopsonistic buyers, then considera-

tion should be given to devising alternative or additional marketing arrangements. Given the prevailing interpretation of the constitution, such action would probably require federal/provincial cooperation. Among the longer-term arrangements which should be considered is an export permit system along the lines used by the National Energy Board or the Uranium Export Review Panel.

(vi) From a strict economic perspective, there appears to be little rationale for not using a Canpotex style arrangement in the U.S.A. market. This follows from the fact that it is in the U.S. that Saskatchewan producers possess their greatest degree of market power. However, it is obvious that there are non-economic issues which must be considered here; nevertheless, it may be useful in the context of U.S./Canada and federal/provincial relations to estimate the extent to which rents are foregone in order to avoid U.S. anti-trust laws or the possibility of other forms of retaliatory action. It may be that Saskatchewan is sacrificing a significant amount of rent in order to ensure the economic prosperity of Canadian enterprises located in other parts of the country.

(vii) The above policy implications are somewhat tenuous due to the lack of empirical evidence on the nature of the critical underlying parameters. In other words, if the short-term price elasticity of demand is, say, -0.5, then the above scenario has strong theoretical merit; if, however, it is -1.5, then the "output expansion" model is more relevant. Thus, it is strongly recommended that additional research be undertaken on the estimation of industry supply and demand elasticities and incremental long-term rents which could be captured under alternative marketing arrangements.

FOONOTES

1. In this chapter, supporting documentation will only be provided if the issue has not been previously addressed within the text, except where reinforcement is deemed appropriate.

2. For more information on this subject, see Chapter 2.5.

3. For important exceptions, see Chapter 3, footnote #42.

4. R.G. Lipsey and K. Lancaster, "The General Theory of Second Best", Review of Economic Studies, Vol. 24, 1956-57, pp. 11-32.

5. The reader is reminded that the relevant domain, in assessing benefits and costs, is assumed to be the Province of Saskatchewan. Hence, policies may be promulgated which appear to be sub-optimal when viewed from a national and, in particular, an international perspective.

6. It is possible that some degree of market power is already being exercised by Saskatchewan-based producers. If so, the important question becomes the extent to which it should be further exploited given that additional employment opportunities will be lost in the process.